# Basismodule

inf031 - Object-oriented Modelling and Programming

<table>
<thead>
<tr>
<th>Module label</th>
<th>Object-oriented Modelling and Programming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>inf031</td>
</tr>
<tr>
<td>Credit points</td>
<td>9.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>270 h</td>
</tr>
</tbody>
</table>

**Used in course of study**
- Fach-Bachelor Informatik > Basismodule
- Fach-Bachelor Mathematik > Nebenfachmodule
- Fach-Bachelor Wirtschaftsinformatik > Basismodule
- Fach-Bachelor Wirtschaftswissenschaften > Studienrichtung Wirtschaftsinformatik
- Zwei-Fächer-Bachelor Informatik > Basismodule

**Contact person**
- Module responsibility
  - Andreas Winter
  - Dietrich Boles
- Authorized examiners
  - Andreas Winter
  - Dietrich Boles
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**

**Module capacity**
- unlimited

**Modullevel**
- ---

**Lern-/Lehrform / Type of program**
- je nach Studiengang Pflicht oder Wahlpflicht

**Vorkenntnisse / Previous knowledge**

**Examination**

<table>
<thead>
<tr>
<th>Final exam of module</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
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<tr>
<td><strong>Course type</strong></td>
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<tr>
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</tr>
<tr>
<td>Exercises</td>
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**Total time of attendance for the module**
- 84 h
## inf200 - Computer Engineering I

<table>
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<tr>
<td>Module code</td>
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<td>Fach-Bachelor Mathematik &gt; Nebenfachmodule</td>
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<td>Zwei-Fächer-Bachelor Informatik &gt; Basismodule</td>
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<td>Contact person</td>
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<tr>
<td>Module responsibility</td>
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<td></td>
<td>Wolfgang Nebel</td>
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<td></td>
<td>Die im Modul Lehrenden</td>
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<tr>
<td>Authorized examiners</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wolfgang Nebel</td>
</tr>
<tr>
<td></td>
<td>Die im Modul Lehrenden</td>
</tr>
</tbody>
</table>

### Entry requirements

The participants learn to understand the construction of digital circuits and digital computers. They know the technological parameters, the state of the art technologies, and the developments characterizing current and future design paradigms for digital hardware. They learn to understand the concepts underlying current computer architectures and are able to explain how such architectures execute programs. Successful participants will be able to analyse computer architectures as a whole, to understand in depth, to analyze, and to optimize their hardware components, and to discuss the properties induced by selecting design alternatives.

### Professional competence

The students:

- identify the fundamental components of digital circuitry and digital computers,
- are aware of the virtues of hierarchical and abstract descriptions of hardware systems,
- name the fundamental parameters, criteria, conditions, and development trends of current and future hardware design
- describe the basic concepts of current computer architectures and the execution of machine programs

### Methodological competence

The students:

- evaluate computer architectures
- design and optimize digital hardware components
- transfer systematic methods of hardware design to unknown design problems

### Social competence

The students:

- present their understanding of the operational principles underlying digital computers to others

### Module contents

This module is the first part of the introduction to computer engineering. It explains the construction principles of computers, from the implementation of an easy Instruction Set Architecture and fundamental methods for the specification, construction and optimization of computer components to elementary components.

### Reader's advisory

- handout manuscript of the course
- Patterson, D.A.; Hennessy, J.L. (1997): Computer Organization and Design:
- The Hardware/Software Interface; 2. Edition; Morgan Kaufmann Publishers.

### Links

- Language of instruction: German
- Duration (semesters): 1 Semester
<table>
<thead>
<tr>
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<td>Modullevel</td>
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<td>Modulart</td>
<td>Pflicht</td>
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### Lern-Lehrform / Type of program

### Vorkenntnisse / Previous knowledge

<table>
<thead>
<tr>
<th>Examination</th>
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<th>Type of examination</th>
<th>Written or oral exam</th>
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<td>Written or oral exam</td>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
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<td>3.00</td>
<td>WiSe</td>
<td>42 h</td>
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<tr>
<td>Exercise or tutorial</td>
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<td>1.00</td>
<td>WiSe</td>
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**Total time of attendance for the module**

|                   | 56 h |
# inf400 - Theoretical Computer Science I

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<th>Theoretical Computer Science I</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<td>Used in course of study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fach-Bachelor Informatik &gt; Basismodule</td>
</tr>
<tr>
<td></td>
<td>Zwei-Fächer-Bachelor Informatik &gt; Basismodule</td>
</tr>
</tbody>
</table>

**Contact person**

- Module responsibility
  - Eike Best
  - Annegret Habel
  - Ernst-Rüdiger Olderog

- Authorized examiners
  - Eike Best
  - Annegret Habel
  - Ernst-Rüdiger Olderog
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

- Introduction to propositional logic, predicate logic, logic programming, and temporal logic

- **Professional competence**
  
  The students:
  
  - Know syntax, semantics and applications of propositional logic, predicate logic, logic programming, and temporal logic
  - Specify problems by using logical formulas
  - Solve questions concerning propositional formulas with truth tables
  - Draw conclusions in the field of propositional logic and predicate logic by means of natural deduction
  - Answer queries to logic programs by using SLD resolution
  - Perform model checking of Kripke structures with regard to CTL formulas algorithmically

- **Methodological competence**
  
  The students:
  
  - Recognize logic as a versatile tool in computer science

- **Social competence**
  
  The students:
  
  - Work together in small groups to solve problems
  - Present solutions to problems to groups of other students

- **Self-competence**
  
  The students:
  
  - Learn persistence in pursuing difficult tasks
  - Learn precision in writing down solutions

**Module contents**

- The course introduces propositional, predicate and temporal logic. In computer science it is essential to have a good understanding of logic because the language of logical formulas is widely used in the field of computer science. For example, Boolean expressions appear in every programming language and in circuit design; Horn clauses are used in knowledge representation; predicate logic and temporal logic are used for specifying software and hardware. More recent applications such as interactive and automatic proving as well as the logic programming language PROLOG emphasize the tool character of logic in computer science.

- The course introduces syntax, semantics, procedures, and calculi to prove the validity of formulas of propositional, predicate, and temporal logic. This is illustrated by many examples. Central is the concept of logical consequence.

- Topics:
  
  - Propositional logic: syntax and semantics, truth tables, natural deduction
  - Predicate logic: syntax and semantics, natural deduction
- Logic programming: declarative and procedural semantics, unification algorithm (Robinson), SLD resolution, PROLOG
- Temporal logic CTL: syntax and semantics of Kripke structures, CTL model checking algorithm

Reader's advisory

Essential:
- Script "Logik" (in German), in its current edition

Recommended:

Good secondary reading:

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Modullevel: BC (Basiscurriculum)
Modulart: Pflicht
Lern-/Lehrform / Type of program: VL + Ü

Vorkenntnisse / Previous knowledge

<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<td>written exam or oral exam</td>
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<table>
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<th>SWS</th>
<th>Frequency</th>
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<td>Exercise or tutorial</td>
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<td>1.00</td>
<td>SuSe</td>
<td>14 h</td>
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Total time of attendance for the module: 56 h
Aufbaumodule

inf005 - Software Engineering I

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<td>Workload</td>
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  • Fach-Bachelor Informatik > Aufbaumodule
  • Fach-Bachelor Mathematik > Nebenfachmodule
  • Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule
  • Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule
  • Zwei-Fächer-Bachelor Informatik > Aufbaumodule

Contact person
Module responsibility
  • Andreas Winter
Authorized examiners
  • Andreas Winter
  • Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module
The objective of the module is to convey the development and maintainance of large scale software systems. The complete software developing process including requirements collection, software architecture and quality control is observed. The basics of object oriented modelling and software development are enhanced.

Professional competence
The students:
  • comprehend the different developmental phases of software (especially requirements engineering, software design, software implementation and quality control)
  • name the tasks of each phase
  • select appropriate methodical utilities
  • select suitable methods and utilities for each project phase
  • understand the advantages of the modelling process with UML
  • model moderate tasks in UML
  • understand and develop solutions for given problems by means of development environments

Methodological competence
The students:
  • structure, document and evaluate problems and solutions with the tools of object oriented modelling
  • apply methods and techniques of object oriented modelling purposefully

Social competence
The students:
  • create, present and discuss solutions with modelling techniques
  • present and solve modelling problems in teams

Self-competence
The students:
  • reflect their problem-solving behaviour with regard to the capabilities of software technology

Module contents
The module introduces fundamental terms and concepts in software engineering. This includes:
  • need for software engineering
  • activities and process-models in software development
  • object-oriented modelling, meta modelling
  • interdependencies between code and models
  • requirements elicitation
  • definition of software architectures
  • application of software patterns
  • software quality management
- software maintenance, evolution and operation

Software engineering tools are presented and applied in practical exercises.

**Reader's advisory**

- Helmut Balzert: Lehrbuch der Software-Technik, Spektrum Akademischer Verlag, 3. Auflage 2009

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

jährlich

**Module capacity**

unlimited

**Modullevel**

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**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

V + Ü

<table>
<thead>
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<th>Type of examination</th>
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<td>Written exam or oral exam or portfolio (? 3 services)</td>
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<table>
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<th>Comment</th>
<th>SWS</th>
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<th>Workload attendance</th>
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**Total time of attendance for the module**

56 h
### inf007 - Information Systems I

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<td>Fach-Bachelor Wirtschaftsinformatik &gt; Aufbaumodule</td>
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<td>Fach-Bachelor Wirtschaftswissenschaften &gt; Studienrichtung Wirtschaftsinformatik</td>
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<td>Master of Education (Wirtschaftspädagogik) Informatik &gt; Mastermodule</td>
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<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>• Marco Grawunder</td>
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<tr>
<td>Authorized examiners</td>
<td>• Marco Grawunder</td>
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<td>• Die im Modul Lehrenden</td>
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<tr>
<td>Entry requirements</td>
<td>This module introduces the core concepts, languages and architectures of databases. In software systems these concepts are important.</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Professional competence</td>
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<tr>
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<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• name the core concepts of the languages and architectures of databases (especially)</td>
</tr>
<tr>
<td></td>
<td>• select data models</td>
</tr>
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<td></td>
<td>• integrate structuring concepts of information systems in their designs</td>
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<td></td>
<td>Methodological competence</td>
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<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• design database systems appropriately</td>
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<tr>
<td></td>
<td>• analyse problems from the field of database-supported information systems and solve them appropriately</td>
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<tr>
<td></td>
<td>Social competence</td>
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<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• enhance their ability to work in a team</td>
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<td>Self-competence</td>
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<td>The students:</td>
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<td>• reflect their problem-solving behaviour with regard to the information processing concepts</td>
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<tr>
<td>Module contents</td>
<td>Relational data models</td>
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<td></td>
<td>Relational algebra and its implementation in SQL (the standard of databases)</td>
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<tr>
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<td>Database design on different abstractions (conceptual and logical design)</td>
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<td>Normalisation</td>
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<td>Data base architectures</td>
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<td>Distributed and active databases</td>
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<td>Object-oriented, object-related and XML-based database systems</td>
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<td>Language of instruction</td>
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<td>Duration (semesters)</td>
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<tr>
<td>Modullevel</td>
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<tr>
<td>Modulart</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<tr>
<td>Lern-/Lehrform / Type of program</td>
<td>V + Ü</td>
</tr>
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</table>

**Vorkenntnisse / Previous knowledge**

<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
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<tbody>
<tr>
<td>Final exam of module</td>
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<td>Hands-on exercises and written or oral exam</td>
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<tr>
<th>Course type</th>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>3.00</td>
<td>WiSe</td>
<td>42 h</td>
<td></td>
</tr>
<tr>
<td>Exercises</td>
<td>1.00</td>
<td>WiSe</td>
<td>14 h</td>
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**Total time of attendance for the module** 56 h
inf010 - Computer Networks

Module label: Computer Networks
Module code: inf010
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Aufbaumodule
- Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Aufbaumodule

Contact person:
Module responsibility:
- Oliver Kramer

Authorized examiners:
- Oliver Kramer
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:

Professional competence:
The students:
- Identify the layers of the ISO/OSI model
- Recognise the main concepts and algorithms of each IOS/OSI layer
- Assign technical processes to the layers
- Classify new technologies to the main concepts of the ISO/OSI model
- Compare different methods and approaches of a layer (i.e. TCP and UDP)
- Characterise safety-critical aspects of each layer

Methodological competence:
The students:
- Administer small networks
- Characterise safety-critical aspects of networks

Social competence:
The students work on exercises in small teams

Self-competence:
The students recognise their administration abilities

Module contents:

Contents of this lecture (cf. suggested reading Tanenbaum and Wetherall)
- Introduction to networks and the internet
- Physical Layer
- Data Link Layer
- MAC Sub-Layer
- Network Layer
- Transport Layer
- Session Layer
- Presentation Layer
- Application Layer
- Technologies (Cable and Co)
- Nyquist Shannon and Transmissions
- CDMA
- Hamming & CRC
- Stop & wait, go back n, selective repeat
- Aloha & CSMA
- Ethernet technologies
- Wifi
- Paket switchen & Dijsktra
- IP Addressing & Header
- TCP
- UDP
- Buckets & TCP-Reno
- DNS
- Flask
- RSA & PGP
- Firewalls
## Reader's advisory

- lecture notes

## Links

http://einstein.informatik.uni-oldenburg.de/20902.html

## Language of instruction

German

## Duration (semesters)

1 Semester

## Module frequency

jährlich

## Module capacity

unlimited

## Module level

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## Modulart

je nach Studiengang Pflicht oder Wahlpflicht

## Lern-/Lehrform / Type of program

V + Ü

## Vorkenntnisse / Previous knowledge


## Final exam of module

<table>
<thead>
<tr>
<th>Course type</th>
<th>At the end of the lecture period</th>
<th>Written or oral exam</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>3.00</td>
<td>SuSe</td>
</tr>
<tr>
<td>Exercises</td>
<td>1.00</td>
<td>SuSe</td>
</tr>
</tbody>
</table>

## Workload attendance

<table>
<thead>
<tr>
<th>Course type</th>
<th>SWS</th>
<th>Frequency</th>
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<td>3.00</td>
<td>SuSe</td>
<td>42 h</td>
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<tr>
<td>Exercises</td>
<td>1.00</td>
<td>SuSe</td>
<td>14 h</td>
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## Total time of attendance for the module

56 h
inf012 - Operating Systems I

Module label: Operating Systems I
Module code: inf012
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Aufbaumodule
- Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule
- Master of Education (Gymnasium) Informatik > Mastermodule

Contact person:
Module responsibility: Oliver Theel
Authorized examiners:
- Oliver Theel
- Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
To gain knowledge of and capabilities in the design, the implementation, and the evaluation of operating systems.

Professional competence:
The students:
- Develop an understanding of operating systems regarding terminology, structure, functionality, conception, central challenges and solutions
- Evaluate the performance of operating systems
- Are aware of the implementation problems of operating systems
- Realise and evaluate solutions of subproblems
- Comprehend and evaluate the functional connections between application systems and hardware
- Understand operating systems as a link between technical and applied computer science

Methodological competence:
The students:
- Transfer concepts of implementations to other contexts
- Question different solutions wrt. properties

Social competence:
The students:
- Solve problems in small teams
- Present their solutions to the members of the tutorial
- Discuss their different solutions with members of the tutorial

Self-competence:
The students:
- Accept criticism
- Question their initial solutions in the light of newly learned methods

Module contents:
The contents of this module are:
1. “Operating systems” definition and structure
2. Requirements of operation systems
3. Technical characteristics of related hardware
4. The need and implementation options of parallel processes
5. Cooperation of processes: communication and synchronisation (semaphores)
6. Memory management: virtual und non-virtual memory management
7. File management

Reader's advisory:

Links:
Language of instruction: German
Duration (semesters): 1 Semester
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<thead>
<tr>
<th>Module frequency</th>
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inf201 - Computer Engineering II

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<tr>
<td>Module responsibility</td>
<td>Wolfgang Nebel</td>
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<tr>
<td>Authorized examiners</td>
<td>Wolfgang Nebel</td>
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<td></td>
<td>Die im Modul Lehrenden</td>
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<tr>
<td>Entry requirements</td>
<td></td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>The module qualifies students to analyse computer architectures, understand computer components, design and optimize computers and components, and to discuss domain-specific hardware design.</td>
</tr>
<tr>
<td></td>
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<tr>
<td>Professional competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* describe computer components</td>
</tr>
<tr>
<td></td>
<td>* design and optimise computer components</td>
</tr>
<tr>
<td></td>
<td>* understand manufacturing processes for VLSI circuits</td>
</tr>
<tr>
<td>Methodological competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* analyse computer architectures</td>
</tr>
<tr>
<td>Social competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* discuss computer hardware and manufacturing processes competently</td>
</tr>
<tr>
<td></td>
<td>* are able to transfer their knowledge of hardware design to other domains different from computer science</td>
</tr>
<tr>
<td>Self-competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* are able to assess their own competences in relation to qualified personnel from related domains</td>
</tr>
<tr>
<td>Module contents</td>
<td>This module is the second part of the introduction to technical computer science. Typical examples of combinatory circuits, like an adder, are used to illustrate modular design methods. More advanced design methods are demonstrated on sequential circuits, i.e. circuits with memory. Additionally in this part, the electrotechnical fundamentals of computing are taught. The construction and the manufacturing process of digital components is explained and the scope of the introduction to computer architecture is broadened to cover embedded systems as well.</td>
</tr>
<tr>
<td>Reader's advisory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Lecture notes</td>
</tr>
<tr>
<td></td>
<td>* Oberschelp, W., Vossen, G.: Rechneraufbau und Rechnerstrukturen; Oldenbourg Verlag</td>
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<td></td>
<td>Additional literature will be mentioned in the lectures</td>
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**Module capacity**  
unlimited

**Modullevel**  
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**Modulart**  
je nach Studiengang Pflicht oder Wahlpflicht

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<td>Written or oral Exam</td>
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<th>Frequency</th>
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<tbody>
<tr>
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<td>42 h</td>
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<tr>
<td>Exercise or tutorial</td>
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**Total time of attendance for the module**  
56 h
inf401 - Theoretical Computer Science II

Module label
Theoretical Computer Science II

Module code
inf401

Credit points
6.0 KP

Workload
180 h

Used in course of study
• Fach-Bachelor Informatik > Aufbaumodule
• Fach-Bachelor Mathematik > Nebenfachmodule
• Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person
Module responsibility
• Eike Best
• Annegret Habel
• Ernst-Rüdiger Olderog

Authorized examiners
• Eike Best
• Annegret Habel
• Ernst-Rüdiger Olderog
• Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module
Introduction to the theory of automata, formal languages, computability, and complexity

Professional competence
The students:

• Know different classes of languages (e.g. regular and context-free languages)
• Know automata models corresponding to the respective language classes (e.g. finite automata, pushdown automata, Turing machines)
• Construct automata, Turing machines, and grammars for given tasks
• Know equivalent formalisations of the concept of algorithm
• Classify functions as algorithmically computable and problems as algorithmically decidable
• Know and recognize undecidable problems
• Evaluate the complexity of algorithms
• Know problems that are solvable deterministically or nondeterministically in polynomial time

Methodological competence
The students:

• Learn about the power of abstract models of computation

Social competence
The students:

• Work together in small groups to solve problems
• Present solutions to problems to groups of other students

Self-competence
The students:

• Learn persistence in pursuing difficult tasks
• Learn precision in writing down solutions

Module contents
In the first part of the course, different classes of languages are introduced (regular and context-free languages).
For each class a matching automata model is presented (finite automata, pushdown automata). Various properties are proven for the introduced classes of languages and models of automata.

In the second part of the course, we examine which functions are computable and which problems are decidable. To this end, the concept of algorithm is formalised. Turing machines and grammars turn out as equivalent approaches. We show that there are problems that are undecidable. Many of these problems are of practical interest.

The third part of the course deals with the complexity of algorithms, i.e. how much time and space is required to solve a problem. In particular, we consider problems that are solvable in polynomial time, either deterministically or non-deterministically. These problems are classified as P and NP.
**Reader's advisory**
- essentiell: Skript "Grundbegriffe der Theoretischen Informatik", jeweils in aktueller Ausgabe
- Gute Sekundärliteratur: Hopcroft, Motwani, Ullman: "Einführung in die Automatentheorie, Formale Sprachen und Komplexitätstheorie", Pearson, 2002 (ein Klassiker...)

**Links**

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<td>Module capacity</td>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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**Vorkenntnisse / Previous knowledge**

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<th>Type of examination</th>
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<td>At the end of the lecture period</td>
<td>Written or oral exam</td>
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<td>WiSe</td>
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**Total time of attendance for the module**

56 h
### mat950 - Discrete Mathematics

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<tr>
<td></td>
<td>Florian Heß</td>
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<tr>
<td></td>
<td>Andreas Stein</td>
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<td>Sandra Stein</td>
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#### Entry requirements

#### Skills to be acquired in this module

#### Reader's advisory

#### Module contents

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- ---

**Module capacity**
- unlimited

**Modullevel**
- ---

**Modulart**
- je nach Studiengang Pflicht oder Wahlpflicht

#### Lern-/Lehrform / Type of program

**Vorkenntnisse / Previous knowledge**

#### Examination

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#### Total time of attendance for the module
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## mat955 - Mathematics of Computer Science (Linear Algebra)

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- **Used in course of study**
  - Fach-Bachelor Informatik > Aufbaumodule
  - Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule

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<td>- Florian Heß</td>
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<td>- Andreas Stein</td>
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### Entry requirements

### Skills to be acquired in this module

### Module contents

### Reader's advisory

### Language of instruction

- **German**

### Duration (semesters)

- **1 Semester**

### Module frequency

- **unlimited**

### Module level

- **---**

### Moduleart

- je nach Studiengang Pflicht oder Wahlpflicht

### Lern-/Lehrform / Type of program

### Vorkenntnisse / Previous knowledge

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<th><strong>Workload attendance</strong></th>
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### mat960 - Mathematics of Computer Science (Analysis)

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**Used in course of study**
- Fach-Bachelor Informatik > Aufbaumodule
- Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule

**Contact person**
- Module responsibility
  - Frank Schöpfer

**Entry requirements**

**Skills to be acquired in this module**
- The students learn and apply basic notions and techniques of mathematical analysis.

**Professional competence**
- The students:
  - use rigorous mathematical proofs
  - compute limit values and analyse the convergence behaviour of iterative methods
  - apply differential and integral calculus to compute extreme values, to analyse the behaviour of functions and to develop numerical solution methods

**Methodological competence**
- The students:
  - analyse formal relations
  - structure and justify solution methods

**Social competence**
- The students:
  - develop solutions to given problems in groups
  - accept constructive criticism

**Personal competence**
- The students:
  - reflect their solution strategies
  - deepen their understanding of the presented mathematical concepts with exercises and adopt the solution methods

**Module contents**
- Convergence of sequences, series and iterative methods
- Continuity, differential and integral calculus of functions of one variable
- Characterization and computation of extreme values
- Separable and linear ordinary differential equations

**Reader's advisory**
- Peter Hartmann: Mathematik für Informatiker - ein praxisbezogenes Lehrbuch
- Dirk Hachenberger: Mathematik für Informatiker
- Otto Forster: Analysis I
- Harro Heuser: Lehrbuch der Analysis, Teil 1
- Konrad Königsberger: Analysis

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- every year

**Module capacity**
- unlimited

**Modulart**
- Pflicht / Mandatory

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Total time of attendance for the module**
- 56 h
Akzentsetzungsmodule

inf006 - Software Engineering II

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Used in course of study
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person
Module responsibility
- Andreas Winter

Authorized examiners
- Andreas Winter
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module
The objective of the module inf005 Software Engineering II is to deepen the subjects and skills of the module Software Engineering I. Special software engineering topics will be presented, deepened and discussed. The lecture deals with different software engineering methods and technology which will be discussed in the seminar. The discussions are contextualised by scientific research projects, practical projects and latest research findings.

Professional competence
The students:
- Deepen software engineering methods and techniques
- Use specific software engineering methods and techniques
- Differentiate developmental techniques of software systems
- Discuss software engineering topics
- Design software systems by using appropriate methods
- Solve software engineering problems independently
- Reflect self-designed software engineering solutions critically and present them appropriately

Methodological competence
The Students:
- Structure problems with modelling techniques
- Develop actual methods of software engineering
- Present software engineering solutions
- Write scientific papers independently

Social competence
The Students:
- Explain and discuss software development solutions in their practical use
- Accept criticism and see it as an asset

Self-competence
The Students:
- Reflect their problem-solving behaviour with regard to the possibilities of software technology
- Internalize the presented developmental methods and integrate them in their own actions

Module contents
The following subjects are provided:
- Concept of systems
- Iterative and agile process models of software development
- System development and cost estimation
- Methods, techniques and tools to collect requirements
- Techniques to develop and describe software architecture
- Measurement and evaluation of software systems
- Extended techniques of modelling, meta-modelling, domain specific languages
- Model based development
- Methods and techniques of software evolution

**Reader's advisory**

- Helmut Balzert: Lehrbuch der Software-Technik, Spektrum Akademischer Verlag, 3. Auflage 2009

and actual papers from IEEE Software, IEEE Transactions on Software-Engineering, Informatik-Spektrum and conferences (z.B. ICSE, ICSM, WCRE, CSMR, ICPC, SLE, u.a.)

**Links**

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
- Module level: ---
- Module type: je nach Studiengang Pflicht oder Wahlpflicht

**Lern- / Lehrform / Type of program**

- Vorkenntnisse / Previous knowledge: Softwaretechnik I
- Examination: Final exam of module
- Time of examination: At the end of the lecture period
- Type of examination: Portfolio (30-minute presentation, 1 paper (4 pages, IEEE) and oral exam)

<table>
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**Total time of attendance for the module**: 56 h
inf008 - Information Systems II

<table>
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<tbody>
<tr>
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   · Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule  
   · Fach-Bachelor Wirtschaftswissenschaften > Studienrichtung Wirtschaftsinformatik  
   · Master Wirtschaftsinformatik > Bereichswahlmodule |
| Contact person     | Module responsibility                     |
|                    | · Marco Grawunder                         |
| Authorized examiners |  · Marco Grawunder  
   · Die im Modul Lehrenden            |
| Entry requirements | The Module “Information Systems II” enhances the knowledge and the concepts of “Information Systems I”. |
| Skills to be acquired in this module | Professional competence |
|                    | The students:                             |
|                    | · Know further concepts, languages and architectures of databases  
   · Analyse advanced information processing tasks  
   · Analyse complex requirements of information systems appropriately  
   · Realize information requirements and gather relevant information |
|                    | Methodological competence                  |
|                    | The students:                             |
|                    | · Propose concrete processing principles for special application classes  
   · Reflect specific technologies’ consequences and proceedings |
|                    | Social competence                         |
|                    | The students:                             |
|                    | Self-competence                           |
|                    | The students:                             |
|                    | · Reflect their problem-solving behaviour with regard to extended information processing concepts |
| Module contents    | Implementation of databases (architecture, index structures, query processing and optimization)  
   · Data integration and data analysis (data integration, data warehouses, data mining)  
   · Information retrieval  
   · Parallel databases |
| Reader’s advisory  | Suggested reading:                        |
|                    | · Härder, T.,Rahm, E.:Datenbanksysteme -Konzepte und Techniken der Implementierung, Morgan Kaufmann  
   · Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, McGraw-Hill  
   · U. Leser, F. Naumann. Informationsintegration: Architekturen und Methoden zur Integration verteilter und heterogener Datenquellen, dpunkt  
   · Bauer/Günzel. Data-Warehouse-Systeme, dpunkt  
   · Han/Kamber/Pei. Data Mining: Concepts and Techniques, Morgan Kaufmann |
<p>| Links              |                                          |
| Language of instruction | German                                  |</p>
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<thead>
<tr>
<th>Duration (semesters)</th>
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<tbody>
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<tr>
<td>Module capacity</td>
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<tr>
<td>Module level</td>
<td>AS (Akzentsetzung)</td>
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<tr>
<td>Modulart</td>
<td>Wahlpflicht</td>
</tr>
<tr>
<td>Lern- /Lehrform / Type of program</td>
<td>VL + Ü</td>
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### Vorkenntnisse / Previous knowledge

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<th>Type of examination</th>
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<td>At the end of the lecture period</td>
<td>written or oral Exam</td>
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<td>1.00</td>
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**Total time of attendance for the module**: 56 h
inf009 - Database Practical

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</tr>
<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<td>Used in course of study</td>
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<tr>
<td></td>
<td>• Fach-Bachelor Informatik &gt; Akzentsetzungsmodule</td>
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<td></td>
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<tr>
<td></td>
<td>• Master of Education (Wirtschaftspädagogik) Informatik &gt; Praktische Vertiefung der Informatik</td>
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<td></td>
<td>• Zwei-Fächer-Bachelor Informatik &gt; Praktische Vertiefung</td>
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<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>• Marco Grawunder</td>
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<tr>
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<td>Authorized examiners</td>
</tr>
<tr>
<td></td>
<td>• Marco Grawunder</td>
</tr>
<tr>
<td></td>
<td>• Die im Modul Lehrenden</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>The objective of this module is to gather practical experience on databases and information systems. The students get an overview of the technical realisation, implementation and optimisation of a professional database management system.</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Professional competence</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• Realise, implement and program database systems</td>
</tr>
<tr>
<td></td>
<td>• Program and implement database-oriented system routines</td>
</tr>
<tr>
<td></td>
<td>• Implement optimisation goals in the modelling phase</td>
</tr>
<tr>
<td></td>
<td>• Administer professional database systems (installation, maintenance and adjustment)</td>
</tr>
<tr>
<td></td>
<td>• Recognise database systems’ performance problems and are able to fix them with according methods</td>
</tr>
<tr>
<td></td>
<td>• Organise and control processes of database systems</td>
</tr>
<tr>
<td></td>
<td>Social competence</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• Solve database system problems in a team</td>
</tr>
<tr>
<td></td>
<td>Self-competence</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• Acknowledge the limits of their ability to cope with pressure during the implementation and are aware of failures</td>
</tr>
<tr>
<td></td>
<td>• Reflect their self-perception</td>
</tr>
<tr>
<td>Module contents</td>
<td>The module “Practical Course Databases” is a related practical course of the module “Information Systems I”. The objectives of this module are special technical concepts of a database system and practical solutions in database programming and optimisation.</td>
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<tr>
<td></td>
<td>Contents of this module are:</td>
</tr>
<tr>
<td></td>
<td>• System-oriented database management programming,</td>
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<tr>
<td></td>
<td>• Implementation of catalogue systems,</td>
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<tr>
<td></td>
<td>• Optimisation strategies based on parallelisation and partitioning requirements</td>
</tr>
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<td>Links</td>
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<tr>
<td>Duration (semesters)</td>
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<td>Emma: Module frequency</td>
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<tr>
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<tr>
<td>Module capacity</td>
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<tr>
<td>Modullevel</td>
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<tr>
<td>Modulart</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>Lern-/Lehrf orm / Type of program</td>
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<table>
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<tr>
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<tbody>
<tr>
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<tr>
<td>SWS</td>
</tr>
<tr>
<td>Frequency</td>
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<tr>
<td>Workload attendance</td>
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inf014 - Operating Systems Practical

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<td>Oliver Theel</td>
</tr>
<tr>
<td>Authorized examiners</td>
<td>Oliver Theel, Die im Modul Lehrenden</td>
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</table>

**Entry requirements**

The aim of this module is to get practical experience in the field of analysis, design, and implementation methods of components of operating systems and their interactions.

**Professional competence**

The students:

- Familiarise with complex software systems
- Implement hardware-related components of operating systems
- Describe parallel system operation executions
- Understand the basic concepts of the programming language C++
- Identify software errors systematically, especially regarding parallel software
- Work in teams
- Use UNIX standard software to solve problems
- Recognise the advantage of working with virtual machines

**Methodological competence**

The students:

- Are aware of the challenges in handling operating systems
- Transfer operating system concepts to a practical context
- Analyse different solutions to a problem wrt. their properties
- Select the most suitable solution

**Social competence**

The students:

- Solve problems in small teams
- Present their solutions to all teams
- Discuss their different solutions within their own team and among all teams

**Self-competence**

The students:

- Accept criticism
- Organise the workflows within their teams
- Question their potential solutions in the light of criticism received
- Identify own shortcomings in their initial ability to successfully transfer theory to praxis

**Module contents**

The contents of this module are:

- Analysis of a rudimentary operating system
- Design and implementation of a process management subsystem
- Design and implementation of process synchronisation mechanisms
- Design and implementation of a virtual memory management subsystem
- Design and implementation of a file subsystem or dialog subsystem
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Links</strong></td>
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<td>• Betriebssysteme I</td>
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<td>• Betriebssysteme II</td>
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<td>• Verteilte Systeme</td>
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<td>• Betriebssysteme II</td>
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<tr>
<td></td>
<td>• Computer language: C, Assembler</td>
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<td>At the end of the semester Active participation / work report and oral exam</td>
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inf015 - Distributed Operating Systems

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<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
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| Used in course of study | ▪ Fach-Bachelor Informatik > Akzentsetzungsmodul  
                           ▪ Master of Education (Gymnasium) Informatik > Mastermodule |
| Contact person     | Module responsibility  
                           ▪ Oliver Theel  
                           Authorized examiners  
                           ▪ Oliver Theel  
                           ▪ Die im Modul Lehrenden |

Entry requirements

Skills to be acquired in this module

This module deals with the fundamentals of distributed operating systems. It gives an understanding of the terminology, structures, functions, conceptions, key problems and implementation concepts of distributed operating systems.

**Professional competence**

The students:

- Evaluate the performance and functionality of distributed operating systems
- Are aware of the realisation problems of distributed operating systems
- Know and evaluate standard methods of solving problems in the context of distributed operating systems
- Use standard methods to solve problems in the context of distributed operating systems

**Methodological competence**

The students:

- Use standard methods of the distributed operating system domain to solve problems in other contexts
- Analyse and rank different solutions in the problem domain wrt. relevant properties

**Social competence**

The students:

- Solve problems in small teams
- Present their solutions to the members of the tutorial
- Discuss their different solutions with members of the tutorial

**Self competence**

The students:

- Accept criticism
- Question their initial solutions in the light of newly learned methods

**Module contents**

The contents of this module are:

1) The historical development towards distributed operating systems
2) Models of distributed computer systems
3) Models of distributed operating systems
4) Design criteria of distributed operating systems
5) Interprocess communication (Computer Networks, Message Passing, Remote Procedure Call)
6) Memory management

- DSM

7) Process management

- Task allocation
- Load balancing
- Load distribution
- Process migration
8) Synchronisation

- Clocks
- Ordering of events
- Distributed mutual exclusion
- Distributed leader election
- Deadlocks

9) Naming and localisation of objects

10) Distributed file systems

11) Fault tolerance concepts

Reader's advisory


Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | jährlich
Module capacity | unlimited
Reference text

Associated with the modules:

- Betriebssysteme I & II
- Betriebssysteme-Praktikum
- Fehlertoleranz in verteilten Systemen (as a possible differentiation)

Module level | ---
Modular | je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program | V+Ü
Vorkenntnisse / Previous knowledge | Betriebssysteme I
Examination | End of the lecture period
Time of examination | Type of examination
Final exam of module | Training tasks, written exam or oral exam
Course type | Comment | SWS | Frequency | Workload attendance
Lecture | 2.00 | SuSe | 28 h
Exercises | 2.00 | SuSe | 28 h
Total time of attendance for the module | 56 h
inf016 - Internet Technologies

Module label: Internet Technologies
Module code: inf016
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule

Contact person:
Module responsibility: Susanne Boll-Westermann
Authorized examiners:
- Susanne Boll-Westermann
- Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
The graduates of the module know different Internet concepts and technologies. They are able to evaluate the capability of the concepts and techniques to design internet-based applications. The students will apply these concepts and techniques in a project.

Professional competence
The students:
- Know basic concepts and technologies of the Internet and the web

Methodological competence
The students:
- Are able to use techniques in projects

Social competence
The students:
- Implement web-based projects in a team

Self-competence
The students:
- Reflect their own capability to develop web-based applications

Module contents:
This module deals with the basic development concepts of internet-based applications. It covers the web languages: HTML, CSS, XML, XML-Schema, XPath, XSTL.
It includes the relevant client technologies of web applications (Applets, AJAX, COMET) and server technologies (Forms, Servlets, Java Server Pages, STRUTS, Ruby on Rails).
Additional topics are multimedia on the internet (SMIL, SVG, Flash), usability and accessibility.

The practical project of this module consists of the design, implementation and presentation of a comprehensive web application. The topics of the lecture will be applied and deepened in practice. The project is based on the web framework Ruby on Rails.

Reader's advisory:
Reserve shelf in the library; extensive list of links in e-learning platform StudIP covering course topics.

Links:
https://www.uni-oldenburg.de/informatik/medieninformatik/lehre/

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited

Reference text:
Associated with the modules:
- Complements with Software-Systementwurf
- Informationssysteme I
**Informationssysteme II**
**Technologien des Wissensmanagement im Internet**

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<tr>
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| Vorkenntnisse / Previous knowledge | - HTML
- Objectoriented programming |

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<th>Type of examination</th>
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<tr>
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<td>The practical projects will all be presented on a single project day, which will take place at the end of the lecture period. The oral exam takes place during the last two weeks of the lecture period. If necessary, re-examinations will take place at the end of the term. Find out more about the schedule on the websites of the department and in StudIP.</td>
<td>Project and oral exam or project and written exam</td>
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<td>SuSe</td>
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**Total time of attendance for the module**

56 h
inf017 - Interactive Systems

Module label: Interactive Systems

Module code: inf017

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:

- Fach-Bachelor Betriebswirtschaftslehrer für Leistungssportlerinnen und Leistungssportler > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Biologie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Chemie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Comparative and European Law > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Engineering Physics > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Interkulturelle Bildung und Beratung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Mathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Nachhaltigkeitsökonomik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Physik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Physik, Technik und Medizin > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Sozialwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Umweltwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Wirtschafts informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschafts informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Anglistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Biologie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Chemie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Elementarmathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Gender Studies > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Germanistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Geschichte > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Materielle Kultur: Textil > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Mathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Musik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Niederlandistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Ökonomische Bildung > PP "Medieninformatik für Studierende musisch-
künstlerischer Fächer“
  - Zwei-Fächer-Bachelor Pädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Philosophie / Werte u. Normen > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Physik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Politik-Wirtschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Slavistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Sonderpädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Sozialwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Sportwissenschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Technik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
  - Zwei-Fächer-Bachelor Wirtschaftswissenschaften > PP "Medieninformatik für Studierende musisch-
    künstlerischer Fächer"

Contact person
Module responsibility
- Susanne Boll-Westermann

Authorized examiners
- Susanne Boll-Westermann
- Die im Modul Lehrenden

Entry requirements
Skills to be acquired in this module
Professional competence
The students:
- name the basic concepts and characteristics of usable user interfaces
- characterise the basic elements of the user-centered design of interactive systems

Methodological competence:
The students:
- characterise the basic approaches to analyse context of use and user requirements
- explain methods for the design and prototypical implementation of interactive systems
- characterise established evaluation techniques and are able to use them

Social competence
The students:
- develop and present solutions for Human-Computer-Interaction related problems

Module contents
The field of interactive systems deals with the tasks, concepts and technologies of human-computer interaction and
its user-friendly and suitable design. The lecture is based on the so-called Human Centred Design Process
and includes models of interaction between humans and their environment, iterative design, prototyping
techniques, study and evaluation processes. Basic design principles, methods and tools are presented.
Practical tasks complete the lecture.

Reader's advisory
- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale: Human Computer Interaction.
- Bernhard Preim, Raimund Dachselt: Interaktive Systeme
- Further articles and papers that are presented in the lecture

Links
Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Modulelevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
V+Ü
### Previous knowledge

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**Total time of attendance for the module**: 56 h
### inf018 - Media Processing

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**Used in course of study**

- Fach-Bachelor Betriebswirtschaftslehre für Leistungssportlerinnen und Leistungssportler > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Biologie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Chemie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Comparative and European Law > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Engineering Physics > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Interkulturelle Bildung und Beratung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Mathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Nachhaltigkeitsökonomik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Physik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Physik, Technik und Medizin > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Sozialwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Umweltwissenschaften > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Wirtschaftswissenschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Wirtschaftswissenschaft > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Master of Education (Gymnasium) Informatik > Mastermodule
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule
- Master of Education (Wirtschaftspädagogik) Informatik > Praktische Vertiefung der Informatik
- Master Wirtschaftsinformatik > Bereichsnuhmodule
- Zwei-Fächer-Bachelor Anglistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Biologie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Chemie > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Elementarmathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Gender Studies > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Germanistik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Geschichte > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Informatik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Informatik > Praktische Vertiefung
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Kunst und Medien > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Materieelle Kultur: Textil > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Zwei-Fächer-Bachelor Mathematik > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Skills to be acquired in this module

Professional competence:
The students:

- name the basic concepts and characteristics of digital media
- name the core concepts of encoding and compressing images, videos and audio files
- characterise the complexity of the analysis, classification and processing of unstructured media, using the examples of image analysis
- apply concepts of encoding, compression and image analysis independently

Module contents

Media processing technologies are presented in the lecture. One focus of the lecture is the encoding of digital images and the compression of an image, image enhancement and image processing. The lecture also deals with encoding and analysis of video and audio. This lecture is accompanied by simple practical tasks.

Reader's advisory

- Reserve shelf in the library; extensive list of links in e-learning platform StudIP covering course topics.

Links

https://www.uni-oldenburg.de/informatik/medieninformatik/lehre/

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

jährlich

Module capacity

unlimited

Modullevel

AS (Akzentsetzung / Accentuation)

Modulart

je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

V+P

Vorkenntnisse / Previous knowledge

Examination

Time of examination

Type of examination

Final exam of module

At the end of the lecture period

Project and oral exam

Course type

Comment

SWS

Frequency

Workload attendance

Lecture

2.00

WiSe

28 h

Project

2.00

WiSe

28 h
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**inf019 - Compiler Construction**

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<td>▪ Die im Modul Lehrenden</td>
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<td>Skills to be acquired in this module</td>
<td>Professional competence</td>
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<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>▪ name the structure of a compiler and each part of the compiling process</td>
</tr>
<tr>
<td></td>
<td>▪ describe the standards of each phase of a compiling process</td>
</tr>
<tr>
<td></td>
<td>▪ understand and evaluate typical characteristics as well as advantages and disadvantages of different methods of the compilation stages</td>
</tr>
<tr>
<td></td>
<td>▪ practically apply the learned methods of the compilation stages</td>
</tr>
<tr>
<td></td>
<td>▪ evaluate the use of a compilation generator</td>
</tr>
<tr>
<td>Methodological competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>▪ link the automata theory and the formal language concepts regarding the compiler construction</td>
</tr>
<tr>
<td>Social competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>▪ develop and present solutions of given problems in small teams</td>
</tr>
<tr>
<td>Module contents</td>
<td>The module provides all steps of a compiler: scanner, parser, semantic analysis, intermediate code generation, code optimisation and machine code generation. Each step is introduced by its current methods. For the parsing step LL-Parser and LR-Parser are presented. The code optimisation step is introduced by different procedures with different conditions for the register optimisation. The lecture essentially follows the book of Aho, Lam, Sethi, Ullman which can validly be described as a compiler construction classic. During practice the introduced methods are practically deepened by small examples and tasks, which the students must carry out independently. A compiler generator (typically ANTLR) is used to demonstrate the practical use of such a tool to the students.</td>
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<td></td>
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<td>Modulart</td>
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<td>V+P</td>
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<td>At the end of the lecture period</td>
<td>Oral exam</td>
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<td>Exercises</td>
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<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
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Total time of attendance for the module 56 h
inf020 - Machine-oriented Programming

**Module label**
Machine-oriented Programming

**Module code**
inf020

**Credit points**
6.0 KP

**Workload**
180 h

**Used in course of study**
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule

**Contact person**

- **Module responsibility**
  - Oliver Theel

- **Authorized examiners**
  - Oliver Theel
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**Professional competence**
The students:

- Comprehend special concepts and methods of low-level programming of tightly-coupled computer systems in C and their translation into NASM assembly language
- Design and implement programs in C independently and systematically translate them into a computer architecture-specific assembly language
- Implement machine-oriented software with appropriate programming and compilation techniques and concepts
- Recognize the relation of technical and practical computer science as well as the relations of high- and low-level programming

**Methodological competence**
The students:

- Understand aspects of the practical and theoretical computer science
- Understand the connection between high level language constructs and low level language constructs
- Translate C programs into NASM programs

**Social competence**
The students:

- Solve problems in small teams
- Present their solutions to the members of the tutorial
- Discuss their different solutions with members of the tutorial

**Self-competence**
The students:

- Accept criticism
- Question their initial solutions in the light of newly learned methods

**Module contents**

- Application areas of machine-oriented programming
- Concepts of the programming language C
- Programming in C
- Setup and structure of tightly-coupled computer systems
- Intel processor architecture
- Assembly languages, in particular NASM assembly language
- Systematical translation of programs from C to NASM assembly language

This module builds a bridge between technical and practical computer science aspects and high-level and machine-oriented programming. The knowledge and skills learned in this module are relevant for machine-oriented system programming, e.g. in realising operating systems and translations of programming languages.

**Reader's advisory**

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**inf021 - Advanced Java Technology Practical**

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**Used in course of study**
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodule
- Master of Education (Wirtschaftspädagogik) Informatik > Praktische Vertiefung der Informatik
- Zwei-Fächer-Bachelor Informatik > Praktische Vertiefung

**Contact person**
- Module responsibility
  - Dietrich Boles
- Authorized examiners
  - Dietrich Boles
  - Die im Modul Lehrenden

**Entry requirements**
- The objective of this practical course is to introduce advanced concepts and technologies of the Java Standard Edition. The students will be able to use the technologies to implement large-scale applications.

**Skills to be acquired in this module**

**Professional competence:**
- The students:
  - Name the essential packages of the JDK class library
  - Structure large-scale programs properly and implement them extensively
  - Set up own Java class libraries
  - Look up required classes in the JDK-Library and solve problems with these classes
  - Structure their programs properly
  - Understand and interpret large-scale programs
  - Evaluate the quality of large-scale programs related to their maintainability, reuseability and expandability

**Methodological competence:**
- The students:
  - Search for solutions on the internet

**Social competence:**
- The students:
  - Discuss own and someone else's solutions

**Self-competence:**
- The students:
  - Reflect their problem-solving behaviour and take up new solutions, e.g. from the internet

**Module contents**
- A selection of the following subjects is presented during the practical course:
  - GUI (AWT, Swing, JavaFX)
  - Java-Basics and Collection-API
  - Graphics and multimedia
  - Events
  - Model-View-Control (MVC)
  - Threads
  - Internationalisation, localization
  - Reflection
  - IO, Files
  - Tools (compiler, classloader, printer, ...)
  - Storage technologies (XML and serialisation)
  - Distributed programming (sockets and RMI)
  - Databases (JDBC)
  - Compression
  - Security concepts
The practical course is based on a large-scale project. This project is developed step-by-step relating to the
subjects of the course.

| Reader’s advisory                          |  |
|--------------------------------------------|  |
| Links                                      | http://www.boles.de/teaching/javapraktikum/index.html |
| Language of instruction                    | German |
| Duration (semesters)                       | 1 Semester |
| Module frequency                           | jährlich |
| Module capacity                            | unlimited |
| Module level                               | --- |
| Modulart                                   | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program           | P |
| Vorkenntnisse / Previous knowledge         | Programmierkurs |
| Examination                                | Time of examination |
| Final exam of module                       | At the end of the lecture period |
| Course type                                | Hands-on training |
| Course type                                | Practical |
| SWS                                        | 4.00 |
| Frequency                                  | WiSe |
| Workload attendance                        | 56 h |
inf203 - Embedded Systems I

Module label: Embedded Systems I
Module code: inf203
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
- Module responsibility
  - Wolfgang Nebel
  - Martin Georg Fränkle
- Authorized examiners
  - Wolfgang Nebel
  - Martin Georg Fränkle
  - Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:

Professional competence
The students:

- name functional and non-functional requirements to specify embedded systems
- discuss design space and associated embedded systems design methods
- name control and feedback control systems' core concepts
- characterise the fundamental digital signal processing algorithms

Methodological competence
The students:

- design and develop embedded feedback control systems with modelling tools
- implement an embedded hardware-/software system according to a given specification
- analyze various specification languages according to different properties

Social competence
The students:

- implement solutions to given problems in teams
- present results of computer science problems to groups
- organize themselves as a team to solve a larger problem using project management methods

Self-competence
The students:

- acknowledge the limits of their ability to cope with pressure during the implementation process of systems
- solve exercises self-responsibly

Module contents:
Embedded systems support complex feedback problems, control problems and data processing tasks. They have an important value creation potential for telecommunications, production management, transport and electronics. The functionality of embedded systems is realised by the integration of processors, special hardware and software. The embedded systems design is influenced by the heterogeneity of system architectures, the complexity of systems and technical and economic requirements.

This module gives an overview of embedded systems and their design. The process of digital signals is especially important for telecommunications and multimedia. For this purpose, the module introduces digital signal processing algorithms. The principles of feedback control are introduced by exemplary transport applications. Subsequently, the module provides the specifications and language characteristics of the embedded system design. For this purpose, graphical data-flow modelling languages (for instance Simulink) and control-flow specifications (for instance StateCharts) are presented. The module closes with the concepts of possible architectures and communication models.

Hands-on exercises with the tools Matlab/Simulink/StateFlow support the module contents.

Reader’s advisory:
Slides and:
Secondary literature:

- Artikelserie zum MPEG-2-Standard 3/94 - 10/94 und das Tutorial "Digitale Bildcodierung" 1/92 - 1/93, beides in "Fernseh- und Kinotechnik" (BIS: Z ell ZA 1536)
inf204 - Embedded Systems II

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<td>Workload</td>
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<td>• Zwei-Fächer-Bachelor Informatik &gt; Basismodule</td>
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</table>

Contact person

Module responsibility

- Wolfgang Nebel
- Martin Georg Fränzle

Authorized examiners

- Wolfgang Nebel
- Martin Georg Fränzle
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module

The module provides an introduction to digital embedded systems design.

**Professional competence:**

The students:

- name embedded systems architectures
- name specific hardware components and architecture designs, particularly processor designs
- characterise the design spaces and associated embedded systems design techniques
- decompose subcomponents of feedback control systems and implement their tasks in different design spaces
- develop software/hardware components
- describe fault-tolerance architecture principles
- describe real-time and safety requirements analysing techniques
- characterise hardware synthesis

**Methodological competence:**

The students:

- estimate the consequences of design decisions in terms of energy usage, performance and reliability component allocations, and designs
- implement an embedded hardware/software system according to a given specification
- model hardware with a hardware description languages
- analyze Hardware/Software systems using event-bases simulation

**Social competence:**

The students:

- implement solutions to given problems in teams
- present results of computer science problems to groups
- organize themselves as a team to solve a larger problem using project management methods

**Self-competence:**

The students:

- acknowledge the limits of their ability to cope with pressure during the implementation process of systems
- deal self responsibly with exercises

Module contents

Embedded systems support complex feedback problems, control problems and data processing tasks. They have an important value creation potential for telecommunications, production management, transport and electronics. The functionality of embedded systems is realised by the integration of processors, special hardware and software. The embedded systems design is influenced by the heterogeneity of system architectures, the complexity of systems and technical and economic requirements.

This module is the continuation of the module “Eingebettete Systeme I” and deals with different architectures of embedded systems and processors.

The module provides system partitioning methods and the synthesis of hardware components.
Hands-on exercises with development tools, hardware description languages and simulation support the module contents.

Reader's advisory

Slides and:


Secondary literature:


Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Reference text: This module is supposed to be a compulsory module for students who are specialising in "Eingebettete Systeme und Mikrorobotik".

Modulelevel: ---
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination | Time of examination | Type of examination | Written or oral Exam
--- | --- | --- | ---
Final exam of module | At the end of the lecture times | | 

Course type | Comment | SWS | Frequency | Workload attendance
--- | --- | --- | --- | ---
Lecture | 3.00 | SuSe | 42 h
Exercises | 1.00 | SuSe | 14 h

Total time of attendance for the module: 56 h
inf205 - Formal Methods in Embedded System Design

Module label: Formal Methods in Embedded System Design
Module code: inf205
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility:
- Martin Georg Fränzle

Authorized examiners:
- Martin Georg Fränzle
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module:

- Embed computer systems sustain a permanent interaction with their environment. This interaction may lead to hardly predictable stimuli and reponse sequences, which complicates the design and validation of such systems tremendously.
- As in more mature engineering disciplines, formal analytical models have been proposed as a remedy. Their role in the design flow is equivalent to the use of structural analysis and material science within, e.g., building statics. Pertinent formal methods for and formal models of embedded systems cover, for instance, execution time, power demand, and possible system dynamics.
- As they represent relevant aspects of a system in a formal, mathematical way, they often permit automatic analysis - i.e., to derive characteristic data - and automatic certificate generation. The distinguishing factor to more traditional forms of analysis like testing and profiling is the exhaustive form of analysis achieved by mathematical methods, which guarantee that the results apply for any environmental interaction. This is in stark contrast to the inherently incomplete coverage provided by test-based methods.
- The lectures explain a series of increasingly more expressive formal models and the related automatic analysis techniques. The exercise classes complement these theoretical insights by hands-on experience with state of the art formal analysis tools and offer the possibility to build such tools oneself.

Professional competence:
The students:
- Evaluate the consequences of certificates applied by formal methods
- Evaluate the suitability of available verification tools for a partial aspect and system class
- Use these tools and interpret their results and improve the examined system
- Prepare system models for automatic analysis methods and abstract or encode the systems symbolically (or otherwise) accordingly
- Design and implement verification algorithms

Methodological competence:
The students:
- Are able to model complex and heterogeneous systems by adequate mathematical modelling techniques
- Know pertinent mathematical models for system dynamics and are able to transfer them to other problem domains.

Social competence:
The students:
- Develop and implement fundamental verification algorithms in teams
- Discuss the relative merits of alternative algorithms and formalisms

Self-competence:
The students:
- Evaluate the consequences of certificates applied by formal methods
- Evaluate the suitability of available verification tools for a partial aspect and system class
- Use these tools and interpret their results and improve the examined system
- Prepare system models for automatic analysis methods and abstract or encode the systems symbolically (or otherwise) accordingly
- Design and implement verification algorithms

Module contents:
The module explains semantic models for reactive, real-time, and hybrid discrete-continuous systems and gives examples for pertinent specification logics. It gradually develops state-exploratory verification algorithms, both of explicit-state and symbolic shape, as relevant to the development of reliable hardware and software systems.

The lectures present the semantic, logical, and algorithmic foundations of the automatic analysis for embedded software systems. The exercise classes complement this by providing space for experimenting with formalisms and tools in teams. The second half of the semester is dedicated to the semester project, which either deals...
with implementing an automatic verifier or with in-depth usage of existing tools on examples of industrially relevant size

Reader's advisory


Links

Language of instruction | German
Duration (semesters)   | 1 Semester
Module frequency       | jährlich
Module capacity        | unlimited
Modulelevel            | AS (Akzentsetzung)
Modularart             | Wahlpflicht

Lern-/Lehrform / Type of program | V+Ü

Vorkenntnisse / Previous knowledge

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Total time of attendance for the module | 56 h
inf207 - Electrical Engineering

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<tr>
<td>Workload</td>
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**Used in course of study**
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

**Contact person**
- Module responsibility
  - Andreas Hein
- Authorized examiners
  - Andreas Hein
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**Professional competence:**
The students:
- Analyse linear electrical networks (direct current and alternating current)
- Name basic concepts to calculate and to use electrical and magnetic fields
- List the characteristics of simple electrical elements (two terminal networks)
- Calculate the parameters of simple electrical networks/wirings
- Apply computer based analysing tools
- Design and implement simple networks/wirings

**Methodological competence:**
The students:
- Transfer calculation methods onto complex dynamic systems
- Implement electrical system models

**Social competence:**
The students:
- Present solutions for specific questions

**Self-competence:**
The students:
- Reflect their solutions by using methods learned in this course

**Module contents**
- Basic concepts (electric dimensions and units)
- Network elements
- Calculation of linear direct current networks (Ohms law, Kirchhoff's circuit law, superposition principle)
- Characteristics, calculations and representations of electric and magnetic fields
- Construction elements (capacitor and coil)
- Extensions of periodical dimensions dependent on time, pointer representation, calculations with complex root-mean-square value pointers

**Reader's advisory**

**essential:**
- slides

**recommended:**
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inf208 - Microrobotics and Microsystems Technology

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<tr>
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| Used in course of study | • Fach-Bachelor Informatik > Akzentsetzungsmodul  
• Master of Education (Gymnasium) Informatik > Mastermodule  
• Zwei-Fächer-Bachelor Informatik > Basismodule |
| Contact person | Module responsibility  
○ Sergej Fatikow  
Authorized examiners  
○ Sergej Fatikow  
○ Die im Modul Lehrenden |
| Entry requirements | |
| Skills to be acquired in this module | Within the last few years, microrobotics and microsystem technology (MST) have become a focus of interest to industry and evolved into an important field with great application potential. It plays a decisive role for industry to be competitive in many areas such as medicine, production engineering, biotechnology, environmental technology, automotive products, etc. Despite of the growing interest in this new technology, there is hardly any book or lecture course that treats microrobotics and MST in a coherent and comprehensive way. This course is an attempt of the Microrobotics and Control Engineering Division (AMiR) to give students a systematic introduction to microrobotics and MST. It discusses all important aspects of this rapidly expanding technology, its diversity of products and fields of application. The course contains an overview of numerous ideas of new devices and the problems of manufacturing them. |
| Professional competence: | The students:  
• name the ideas, challenges and activities of microrobotics and microsystem technology  
• describe the microrobotics and MST applications  
• characterise MST methods  
• name microsensor functionality  
• characterise microsensor examples  
• discuss MST terms of information technology  
• classify microrobotics |
| Methodological competence | The students:  
• discover interdisciplinary connections and links between scientific and technical fields of research and development  
• learn technical abstraction of complex contexts |
| Social competence | The students:  
• solving problems partially as group  
• present their solutions and approaches to the group |
| Self-competence | The students:  
• reflect their knowledge of technical computer science  
• learn to expand on their professional competence independently |
| Module contents | Ideas and problems of microrobotics and MST; applications; techniques of MST; silicon-based micromechanics; LIGA technology; microactuators: principles and examples (electrostatic, piezoelectric, magnetostrictive, electromagnetic, SMA-based, thermomechanical, electro rheological and other actuators); microsensors: principles and examples (force and pressure, position and speed, acceleration, biological and chemical, temperature and other sensors); MST and information processing; microsystem design and simulation; classification of microrobots; coarse positioning of a microrobot; fine positioning of a microrobot; handling of microparts: problems and solutions; micro grasp techniques; microassembly; process automation by microrobots; desktop robot cell in SEM |
| Reader's advisory | Essential:  
• |
Lecture notes

Recommended:


Secondary Literature (only available for some subareas):

- Elbel, Th.: Mikrosensorik, Vieweg, Wiesbaden, 1996
- Völklein, F. und Zetterer, Th.: Einführung in die Mikrosystemtechnik, Vieweg, Wiesbaden, 2000

Links

Language of instruction German
Duration (semesters) 1 Semester
Module frequency jährlich
Module capacity unlimited
Reference text Associated with the modules: Embedded Systems and Microrobotics
Modullevel ---
Modulart je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge Analysis II or Numerics
Examination Time of examination Type of examination
Final exam of module At the end of the semester Oral exam in German
Course type Comment SWS Frequency Workload attendance
Lecture 3.00 WiSe 42 h
Exercises 1.00 WiSe 14 h
Total time of attendance for the module 56 h
inf209 - Control Theory

Module label: Control Theory
Module code: inf209
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility
- Sergej Fatikow
- Andreas Hein
Authorized examiners
- Sergej Fatikow
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements:
- Module Differential Equations
- Module Basics Electrical Engineering

Skills to be acquired in this module:
Instruction on theoretical and mathematical basics of control engineering

Professional competence
The students:
- Describe the core principles of steering and control of technical systems
- Discuss the modellling core concepts of systems and their controllers
- Name methods to determine the quality of controlled systems
- Model technical systems with differential equations and their transfer functions
- Develop control structures, evaluate their stability and determine their optimal control parameters

Methodological competence
The students:
- Are aware of the technical challenges and solve them by including the implementations of other disciplines and methods

Social competence
The students:
- Present solutions for specific questions

Self-competence
The students:
- Get used to the specific challenges of the development of controlled systems

Module contents
Basics; analog transfer elements; linear time invariant (LTI-) systems; simulation and modeling; step response; frequency response; frequency response locus; differential equations and transfer function; control loop stability; types of controlled systems; types of linear controllers; linear control loops; reference and disturbance reaction of the controlled system; rules for control loop optimization; methods of analysis and synthesis, implementation; computerbased control MATLAB/Simulink

Reader's advisory
Unbehauen, H.: Regelungstechnik I, Klassische Verfahren zur Analyse und Synthese linearer kontinuierlicher Regelsysteme
Lutz, H. und Wendt, W.: Taschenbuch der Regelungstechnik
Further reading will be announced at lecture

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**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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**Total time of attendance for the module**

56 h
inf210 - Signal and Image Processing

Module label: Signal and Image Processing
Module code: inf210
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility:
- Martin Georg Fränzle
- Andreas Hein

Authorized examiners:
- Martin Georg Fränzle
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module

Professional competence:
The students:
- Name the concepts of signal and image processing in technical systems
- Name the methods/algorithms of preprocessing, filtering, classification, interpretation and visualisation of signals and pictures
- Select algorithms appropriately
- Evaluate the effectiveness of algorithms
- Design algorithms and processing chains and evaluate their quality

Methodological competence:
The students:
- Get used to specific subjects of signal and image processing

Social competence:
The students:
- Present solutions for specific questions in signal and image processing

Self-competence:
The students:
- Reflect their solutions by using methods learned in this course

Module contents:

- Basic Concepts
- Signal Processing
- Signal Spaces and Signal Processing Systems
- Discrete and Constant Signals
- Labelling of Signal Transmitters with Test Signals
- Representations Areas and Transformations
- Time-Discrete Systems and Scanning
- Estimation and Filtering
- Construction with MATLAB
- Image Processing
- Introduction / Range of Applications
- Functional Transformation
- Image Enhancement/Filtering
- Segmentation
- 3D Reconstruction an Visualization

Reader's advisory:

essential:
- Slides
### Links

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<td>V &amp; Ü</td>
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**Total time of attendance for the module**

56 h
inf402 - Graph Transformation Systems

Module label: Graph Transformation Systems
Module code: inf402
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility: Annegret Habel
Authorized examiners: Annegret Habel, Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
Modelling of systems, introduction to graph transformation systems, sequential and parallel independence, termination and confluence.

Professional competence:
The students:
- Know the basics of graph transformation systems and graph programs
- Describe graph transformation systems and graph programs
- Define the Turing completeness of graph programs
- Model systems and system changes
- Prove sequential and parallel independence of derivations
- Prove termination and confluence of graph transformation systems

Methodological competence:
The students:
- Recognize graph transformation systems as a versatile tool for modelling in computer science

Social competence:
The students:
- Work together in small groups to solve problems
- Present solutions to problems to groups of other students

Self-competence:
The students:
- Learn persistence in pursuing difficult tasks
- Learn precision in writing down solutions

Module contents:
Graphs are practically used in all areas of computer science to display complex structures. Some examples are flow charts, circuit diagrams, record structures, parse trees and functional and logical expressions. Such structures can be dynamically changed by graph rewriting systems. The changing process is represented by rewriting rules. This module gives an introduction to the field of graph transformation systems. It deals with reversibility, embedding and restriction of derivations, sequential and parallel independency, termination and confluence.

Reader's advisory:

Links:
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: im 2-Jahres-Zyklus
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<th>Vorkenntnisse / Previous knowledge</th>
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**Total time of attendance for the module**: 56 h
inf403 - Cryptology

Module label: Cryptology
Module code: inf403
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility:
- Elke Wilkeit

Authorized examiners:
- Elke Wilkeit
- Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
Cryptology is a key technology for the security of worldwide computer nets. Modern cryptographic techniques are used to keep data secret, sign electronic messages, control computer network access, secure electronic financial transactions, protect copyrights, among others. In view of these applications users should be able to assess the efficiency and security of these key technologies. For this purpose, it is important not only to know the function of cryptographic processes, it is also important to understand their mathematical basics. Both is explained in this module.

Professional competence
The students:
- identify basic concepts of cryptography and explain them by examples
- know relevant cryptosystems, apply them and assess their security
- are familiar in using mathematical basics of cryptographic algorithms
- implement cryptographic algorithms and prove their correctness and estimations of their complexity

Methodological competence
The students:
- assess the efficiency and security of cryptographic processes
- extend their knowledge about algorithms and their complexity
- develop their implementation skills in particular the handling of very large numbers
- analyze simple encryption using well-known and own techniques

Social competence
The students:
- use the language of mathematics to discuss in groups with different knowledge about problems
- present their ideas in an understandable way
- expand and improve their own ideas through the proposals of their fellow students

Self-competence
The students:
- reflect their knowledge about security in IT systems
- reflect their knowledge about algorithms and their complexity
- experience the development of a new field of knowledge within a short amount of time
- discover new applications of mathematical contexts

Module contents:
A) Mathematical Basics: Integers; Polynomials; Congruences; Residue Class Rings
B) Encryption
C) Probability and Perfect Security
D) Symmetric Encryption (DES, AES)
E) Generation of Prime Numbers
F) Public-Key-Encryption
G) Factorisation and Discrete Logarithms
H) Cryptographic Hash Functions and Digital Signatures
I) Identification and Certification

Reader's advisory:
Lecture notes; further literature will be announced in the lecture.
For attunement: Singh, Simon: The Code Book: Science of Secrecy from Ancient Egypt to Quantum

Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: jährlich

Module capacity: unlimited

Module level: ---

Moduleart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge: Mathematical and computer science basics

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Total time of attendance for the module: 56 h
**inf404 - Petri Nets**

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<td>© Die im Modul Lehrenden</td>
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<td>Entry requirements</td>
<td>The behaviour of modern, highly parallel, digital systems may be extremely complex. Graphical and algorithmic support may be very valuable in facilitating their design, construction, and analysis. Petri nets are a basic, widely used graphical model for the specification of parallel systems. They also provide and support a range of flexible algorithmic methods for the analysis of such systems. This module teaches the basic theory and applications of Petri nets, for the purpose of specifying and visualising, as well as for constructing and analysing highly parallel systems.</td>
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<td>• define basic concepts of Petri nets</td>
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<td>• classify Petri nets according to their salient properties</td>
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<td>• analyse and synthesise Petri nets</td>
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<td>• apply Petri nets in the context of well-defined problems</td>
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<td>• present solutions to given problems to a wider audience</td>
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### Lern-/Lehrform / Type of program

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#### Course type

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**Total time of attendance for the module**

56 h
Inf405 - Algorithmic Graph Theory

Module label: Algorithmic Graph Theory
Module code: Inf405
Credit points: 6.0 KP
Workload: 180h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
- Elke Wilkeit

Authorized examiners:
- Elke Wilkeit
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:
Graphs are the most frequently used abstraction in computer science. Every system which consists of discrete states or objects and relations between these can be modelled as a graph. Most applications require efficient algorithms to process such graphs (Turau, 1996). This module provides typical graph theory problems and algorithmic solutions. They are discussed with regard to their efficiency and applicability and many of the algorithms will be implemented. An important aspect of this module is to consider different approaches to problems and learn different solution strategies.

Professional competence
The students:
- identify basic terms of graph theory and optimization and illustrate them with examples
- name typical graph theory problems and algorithmic solutions
- identify situations where graph algorithms can be applied
- discuss typical graph theory problems and algorithmic solutions with regard to their efficiency and applicability.
- implement graph algorithms
- know proof strategies and are able to apply them

Methodological competence
The students:
- extend their knowledge about algorithms and their complexity
- develop their programming skills
- expand their range of methods of mathematical modelling

Social competence
The students:
- use the language of mathematics to discuss problems in groups with different knowledge levels
- present their ideas in a comprehensible way
- Expand and improve their own ideas through the comments of their fellow students

Self-competence
The students:
- reflect their knowledge about algorithms and their complexity
- develop appropriate solutions for given problems
- challenge methods of resolution

Module contents:
- A) Trees
- B) Search Algorithms
- C) Graph Coloring
- D) Flows in Networks
- E) Applications of Network Algorithms
- F) Shortest Paths
- G) Approximation Algorithms

Reader's advisory:
A detailed bibliography is contained in the lecture notes of this module.

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Lern-/Lehrform / Type of program

| Vorkenntnisse / Previous knowledge | Mathematical and computer science basics |

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| Total time of attendance for the module | 56 h |
inf406 - Laboratory Real-Time Systems

Module label
Laboratory Real-Time Systems

Module code
inf406

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Wirtschaftspädagogik) Informatik > Praktische Vertiefung der Informatik
- Zwei-Fächer-Bachelor Informatik > Praktische Vertiefung

Contact person
Module responsibility
- Ernst-Rüdiger Olderog

Authorized examiners
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Entry requirements
Theoretische Informatik I und II

Skills to be acquired in this module
The students learn about methods and tools, and how to apply, specify, simulate, verify, and implement real-time systems (RTS). The students gain hands-on experience using tangible Mini-Robots (Lego Mindstorms).

Professional competence
The students:
- implement RTS with Lego Mindstorm Robots NXT
- simulate and verify RTS on the basis of real-time automata with the model checker UPPAAL
- apply the tool Moby/RT to specify and simulate RTS on the basis of PLC-Automata, and to translate them into Java-Code for Lego Mindstorms NXT and into UPPAAL

Methodological competence
The students:
- realise control tasks with Lego Mindstorms
- specify RTS as networks of real-time automata and verify them with UPPAAL
- design RTS using Moby/RT
- realise systematically sophisticated time-dependent control tasks with Moby/RT, Lego Mindstorms, and UPPAAL

Social competence
The students:
- solve tasks in a team
- present solutions and discuss them

Self-competence
The students:
- recognise (sub-)problems of RTS and are responsible for their realisation

Module contents
Real-time-systems are systems, where the time at which an output is generated or at which data are read is of importance. Compared to usual programming methods, RTS models are extended by the additional dimension of time. An example for a RTS is an airbag in a car, which needs to be triggered at the right moment of time, not too early and not too late, because the effect of the airbag is useful only for a few hundredths of seconds.

The course introduces methods and tools which are then practically applied to specify, verify, and implement RTS. The students gain hands-on experience using Mini-Robots (Lego-Mindstorms) to implement RTS.

Reader's advisory

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited
| Modullevel | --- |
| Modulart | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program | P |

### Vorkenntnisse / Previous knowledge

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### Course type
- Practical

| SWS | 4.00 |
| Frequency | WiSe |
| Workload attendance | 56 h |
## Module: Program Verification

### Module Information

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<td>Workload</td>
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**Used in course of study**

- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

**Contact person**

- Module responsibility
  - Ernst-Rüdiger Olderog
- Authorized examiners
  - Ernst-Rüdiger Olderog
  - Die im Modul Lehrenden

### Entry requirements

**Skills to be acquired in this module**

**Introduction to methods for proving the correctness of sequential, parallel, and distributed programs.**

**Professional competence**

The students:

- Describe operational semantics of sequential, parallel, and distributed programs
- Know the concepts of partial and total correctness of programs
- Establish soundness and completeness of proof systems
- Construct input-output specifications of programs
- Conduct correctness proofs for programs of different classes with the help of proof rules
- Check interference and deadlock freedom of parallel programs
- Transform parallel and distributed programs into nondeterministic programs

**Methodological competence**

The students:

- Recognize correctness as an important aspect of programs and informatics systems

**Social competence**

The students:

- Work together in small groups to solve problems
- Present their solutions to groups of other students

**Self-competence**

The students:

- Learn persistence in pursuing difficult tasks
- Learn precision in specifying problems

### Module contents

Program verification is a systematic approach to show the absence of errors in programs. For this purpose desirable behavioural properties of a given program are proven. For instance, a sorting program should only deliver sorted arrays.

Partial correctness, termination, and the absence of runtime errors are essential for sequential programs. Additional behavioural properties are of interest for parallel programs: absence of interference, absence of deadlocks, and fair behaviour.

The module focuses on the verification of parallel programs. For this purpose classic methods of Hoare's logic are combined with more recent techniques of program transformation. Sequential programs are covered in preparation for this.

### Reader's advisory

**essential:**


**Or the extended English version:**

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inf408 - Algorithms for Software Verification

Module label: Algorithms for Software Verification

Module code: inf408

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Master of Education (Gymnasium) Informatik > Mastermodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility
- Ernst-Rüdiger Olderog

Authorized examiners
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:

Algorithms are presented that enables an automatic analysis and verification of complex structures as used in software systems. In the exercises these algorithms will be implemented and applied to case studies.

Professional competence:

The students:
- conduct CTL model checking using examples
- construct abstract Kripke structures on the basis of given data abstractions and apply abstraction refinement to examples
- characterise the concepts of simulation and bisimulation
- understand the concept of data and transition abstraction
- describe model checking methods as instances of fixed-point algorithms

Methodological competence:

The students:
- specify reactive systems by means of Kripke structures and CTL formulas
- implement model checking methods using Java

Social competence:

The students:
- work in small groups

Self-competence:

The students:
- reflect their actions and use newly learned methods

Module contents:

Software systems consist of complex data and control structures and growing state spaces, which makes testing their correctness difficult. The big challenge for computer science is the development of automatic methods to analyse and to verify software systems’ properties. In this course, algorithms for program analysis and model checking are presented and applied. The algorithms process transition systems generated from software and use abstraction techniques for data and transitions to make the state spaces analysable.

Topics:

Kripke structures, transition systems, temporal logic CTL and CTL*, fixed-point algorithms for recursive CTL-operators, model checking algorithms for CTL, simulation and bisimulation of Kripke structures, theorems on the preservation of properties under (bi-) simulations, existential und universal abstraction of Kripke structures, counterexample-guided abstraction refinement (CEGAR method)

Reader's advisory:


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inf409 - Formal Languages

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Entry requirements

Skills to be acquired in this module

- Introduction to syntactic analysis and compiler construction.

**Professional competence**

The students:

- Know the fundamentals of syntactic analysis and compiler construction
- Describe the complexity of fundamental syntactic analysis algorithms
- Construct no-left-recursive-grammars and grammars in normal form
- Test LL(k) and LR(k) characteristics of context-free grammars
- Construct LL(k)-Parsing and LR(k)-Parsing-Action and GOTO tables
- Apply basic syntax analysis algorithms

**Methodological competence**

The students:

- Perceive syntax analysis algorithms as a essential tool in computer science

**Social competence**

The students:

- Work together in small groups to solve problems
- Present their solutions to groups of other students

**Self-competence**

The students:

- Learn persistence in pursuing difficult tasks
- Learn precision in writing down solutions

**Module contents**

The course introduces the fundamentals of syntax analysis and considers backtrack parsing (Top-Down & Bottom-Up Backtracking), tabular parsing methods (Cocke-Younger-Kasami & Earley) und One-Pass No Backtrack Parsing (LL(k) und LR(k)).

**Reader's advisory**


**Links**

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: im 2-Jahres-Zyklus
- Module capacity: unlimited
| Modullevel | --- |
| Modulart | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program | V & Ü |
| Vorkenntnisse / Previous knowledge | Theoretische Informatik II |

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**Total time of attendance for the module**: 56 h
inf521 - Medical Informatics

Module label: Medical Informatics
Module code: inf521
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule

Contact person:
Module responsibility: Rainer Röhrig
Authorized examiners:
- Rainer Röhrig
- Die im Modul Lehrenden

Entry requirements:
This module provides an introduction to the medical informatics and medical technology.

Professional competence
The students:
- know the medical and healthcare computer science applications
- know typical IT solutions and infrastructures
- know the legal framework to process care data
- know medical classifications and nomenclatures and the DRG-System and are able to apply them

Methodological competence
The students:
- know bio-medical research requirements and patient data privacy methods
- know communication standards and apply them in small-scale scenarios
- know and apply patient safety and risk management methods
- know and apply biosignal and image processing methods

Social competence
The students:
Realise the importance of communication during the software development process between developer, customer and user of a successful and secure system. Feedback, request, respectful cooperation and the empathy of other disciplines’ working processes are of great importance.

Self-competence
The students:
Realise their responsibility as a medical informatic and reflect their impact on patients, medical employers and hospitals (corporates)

Module contents:
- Medical informatics introduction / medical documentation
- Medical documentation / progression of disease
- Healthcare information systems
- Terminology and classification / Medical controlling
- Image processing / interoperability and communication standards
- Medical data privacy
- Medical research
- Analyses of information system data
- Decision making support and process management
- MI/MT patient safetiness (Regulatory Affairs)
- Telemedicine / Customer Health informatics
- Medical technology introduction, biomedical technology
- Biosignal processing, sensor technology
- Robotics, prosthetics

Reader’s advisory:
- Jan van Bemmel, M.A. Musen, Mark A. Musen (Hrsg.): Handbook of Medical Informatics. Springer, Heidelberg 1997
- Christian Johner und Peter Haas (Hrsg.): Praxishandbuch IT im Gesundheitswesen
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<td>Written or oral exam</td>
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**Total time of attendance for the module**: 56 h
inf530 - Artificial Intelligence

Module label: Artificial Intelligence
Module code: inf530
Credit points: 6.0 KP
Workload: 180 h

Used in course of study
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodule
- Master of Education (Gymnasium) Informatik > Mastermodule

Contact person
Module responsibility
- Jürgen Sauer

Authorized examiners
- Jürgen Sauer
- Die im Modul Lehrenden

Entry requirements
Skills to be acquired in this module
The students are familiar with the basic concepts of artificial intelligence (AI). They know the concept of rational agents and their behavior. They know how to implement expert systems. They also know basic search and problem solving techniques as well as techniques of knowledge representation. The students can compare different problem solving techniques and use them within other problem contexts.

Professional competence
The students:
- describe the concept of rational agents and their behavior in an agent environment
- name and describe the basic search and problem solving techniques of Artificial Intelligence
- describe and implement expert systems
- describe basic techniques of knowledge representation

Methodological competence
The students:
- acknowledge the basic methods of AI
- transfer AI methods to other application areas
- evaluate AI methods regarding their appropriateness for distinct problem areas
- modify and adapt AI methods for specific application areas

Social competence
The students:
- work in teams
- present results to groups

Self-competence
The students:
- reflect their results with regard to the methods of AI

Module contents
- Overview of AI
- Rational agents and agent based systems
- Search and other problem solving techniques
- Knowledge representation
- Planning

Reader's advisory

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### Examination

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<td>Exercises</td>
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### Total time of attendance for the module

56 h
inf600 - Business Informatics I

Module label: Business Informatics I
Module code: inf600
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Fach-Bachelor Nachhaltigkeitsökonomik > Basismodule
- Fach-Bachelor Wirtschaftsinformatik > Basismodule
- Fach-Bachelor Wirtschaftswissenschaften > Studienrichtung Wirtschaftsinformatik
- Master of Education (Gymnasium) Informatik > Mastermodule
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule

Contact person:
Module responsibility: Axel Hahn
Authorized examiners:
- Axel Hahn
- Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
Business informatics regards itself as an interdisciplinary subject. It connects business administration with computer science. Business informatics also includes information technologies as well as technical subjects and research topics. It is more than just an intersection of research fields and offers e.g. special methods to coordinate corporate strategies and information processing. The module introduces the entire scope of the field of business informatics.

Professional competence
The students:
- Describe the key aspects of business informatics
- Differentiate business informatics as an interdisciplinary subject from other subjects
- Characterise the functionality of essential application systems and management structures, from the strategical to the tactical and operative level.
- Consider and evaluate case studies and layout options for the conception, development, implementation, usage and maintenance of operational sociotechnical applications systems

Methodological competence
The students:
- Model technical and sociotechnical processes using suitable tools
- Analyse business processes and the demands on their modification and their technical assistance
- Abstract from complex systems in a suitable way to improve the manageability of models

Social competence
The students:
- Present their solutions in front of other groups
- Discuss their outcomes

Self-competence
The students:
- Develop solutions for case studies in groups
- Construct an argument based on acquired knowledge

Module contents:
The main topics of business informatics are the presentation and evaluation of configuration options to conceptualise, develop, implement, use and maintain operational sociotechnical application systems. The lecture focusses on information systems of the networked company. Technical, economic, organisational, and psychosocial aspects are considered. The understanding of these relations will be trained by means of case studies taken from Laudon et al. (cf. suggested reading). The lecture gives an overview of the following business informatics fields:
- Information systems, (object of BI)
- Application systems
- E-Commerce and E-Business
- Ethical, social and political aspects
- Business process integration
- Knowledge management
- Support of decision making
- Reorganisation of companies
- Economic evaluation

For a better understanding of each subject, it is recommended to take specific modules later in the course of studies.

Reader's advisory
- Frank, Gronau (2002), Systemanalyse im Unternehmen Oldenbourg (Gebundene Ausgabe - Juni 2002)

Links

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
- Modullevel: ---
- Modulart: je nach Studiengang Pflicht oder Wahlpflicht
- Lern-/Lehrform / Type of program: V & Ü

Vorkenntnisse / Previous knowledge

| Examination     | Time of examination | Type of examination | Tasks and active partaking during the exercises / written exam or oral exam
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Total time of attendance for the module: 56 h
inf601 - Business Informatics II

Module label: Business Informatics II
Module code: inf601
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Basismodule
- Fach-Bachelor Wirtschaftswissenschaften > Studienrichtung Wirtschaftsinformatik
- Master of Education (Gymnasium) Informatik > Mastermodule

Contact person:
Module responsibility:
- Jorge Marx Gomez
Authorized examiners:
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
The module provides the fundamentals and tasks of information management to create an IT strategy. Tasks are especially considered from a strategic perspective and brought closer by methodological skills for each task.

Professional competence:
The students:
- name the strategic aspects of information management and identify their impact on technical and operational information management
- examine the essential questions of enterprise reorganization in connection with an information system and recognize the influence of the Internet and its services on commercial processes and information systems by an exemplary system, e.g. SAP R/3
- identify different approaches to information management (Information Resource Management, Management approach, management approach, personal information management) and understand why determining the value of information management is necessary and how it is done
- specify the objectives of information management, differentiate and classify its tasks appropriately
- recognize the methodological characteristics of information management
- transfer the concept of architecture to the information infrastructure
- assess the importance to plan features for strategic IT-design oriented on IT-architecture
- schedule the procedures concerning the strategical situation analysis of the competition analysis, the information infrastructure and the environmental analysis with the objective to transfer them to simple problems
- name the key contents of strategical IT objectives and are aware of difficulties in determining the measurement category
- identify and learn the scope and central tasks of business process and environmental management (as excursion) and the significance for information management

Methodological competence:
The students:
- perform information management tasks using methods of Information Engineering and thereby learn how to transfer and employ the methods to other fields, e.g. economy
- learn by practice advantages and disadvantages of different methods and can use them as part of the optimized IT strategy based on the acquired knowledge.

Social competence:
The students:
- construct solutions to case studies given in the group, i.e. the development of an IT strategy
- discuss the solutions on a technical level
- present the solutions to case studies as part of the exercises

Self-competences:
The Students:
accept criticism and understand it as a precondition for the further development of one's own actions

Module contents:
The proportion of information technology in the investment budget of companies is rising continuously. For instance, banks spend 25% of all investments for their information systems. Information is not just a production factor, it is also an element of competition. Information is increasingly important for business. The business informatics deals with these economic tasks of information technology.
Information systems in businesses and organisations are of central concern. The interdisciplinary nature of business informatics raises questions about proceedings, problems of models (modelling in a narrow sense) and the application in specific problem domains.

Contents of this module are:

- Information management principles and tasks
- IT architectures
- Infrastructure of information and communication technology
- Strategic, administrative and operative information engineering

Reader's advisory

- Heinrich, Stelzer (2011): Informationsmanagement - Grundlagen, Aufgaben, Methoden. Oldenbourg Verlag
- Krcmar (2015): Informationsmanagement. Springer Verlag

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Total time of attendance for the module 56 h
inf603 - Planning and Simulation in Logistics

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<td>Jürgen Sauer</td>
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<tr>
<td>Authorized examiners</td>
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<td>Die im Modul Lehrenden</td>
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<tr>
<td>Entry requirements</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>Introduction to the problems/challenges of simulation and planning of applications in production and logistics. The students will learn the simulation with a tool in hands-on exercises.</td>
</tr>
<tr>
<td>Learning objectives:</td>
<td>The Students have knowledge of basic problems/challenges of simulating and planning in the field of production and logistic. They know approaches and algorithms to solve simulation and planning problems/challenges. They are able to model solutions for simple production problems/challenges with a simulation tool and are able to solve given tasks with it.</td>
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<tr>
<td>They are able:</td>
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<tr>
<td></td>
<td>to identify, classify and associate solutions to problems/challenges</td>
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<td></td>
<td>to model and implement a production plan with the simulation tool</td>
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<tr>
<td>Professional competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>Characterise basic problems/challenges of the production planning and logistic simulation</td>
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<td>Name approaches/concepts and algorithms to solve simulation and planning problems/challenges</td>
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<td>Identify, classify and assign solutions to planning problems/challenges</td>
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<td>Model and implement a given production process with a simulation tool</td>
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<td>Methodological competence</td>
<td>The students:</td>
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<td>Model small production problems with a simulation tool and solve given tasks with the tool</td>
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<td>Social competence</td>
<td>The students:</td>
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<tr>
<td></td>
<td>Develop solutions to given simulation problems in small groups</td>
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<td>Present the solutions to other groups</td>
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<td>Self-competence</td>
<td>The students:</td>
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<td>Reflect their own solutions in conjunction with other solutions</td>
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<td>Module contents</td>
<td>This module provides the basic production and logistic planning and simulation approaches/concepts. Supply chain planning problems are introduced and simple algorithmic solutions are introduced and implemented. The hands-on simulation with a tool is provided by a case study from the production.</td>
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| Total time of attendance for the module   | 56 h     |
### inf608 - eBusiness

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#### Used in course of study
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule
- Fach-Bachelor Wirtschaftswissenschaften > Studienrichtung Wirtschaftsinformatik
- Master of Education (Gymnasium) Informatik > Mastermodule
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule

#### Contact person
- Module responsibility
  - Jorge Marx Gomez
- Authorized examiners
  - Jorge Marx Gomez
  - Die im Modul Lehrenden

#### Entry requirements

#### Skills to be acquired in this module

**Professional competence**
The students:

- Name and discuss the eBusiness key challenges
- Discuss the chances of the added value and the changes of commercial models by the internet
- Define the concepts of e-business and e-commerce.
- Discuss the change of retail trade and the transactions between companies in e-business
- Name current payment systems and communication technologies
- Discuss the possibilities of the internet in order to simplify the administration and the coordination of internal and external business processes
- Characterise the challenges for the management caused by e-business and e-commerce
- Differentiate the concepts and conceptualites of e-business
- Assess applications with regard to economic points of view
- Practically learn how to handle core technologies of e-business

**Methodological competence**
The students:

- Assess the core technologies of e-business and e-commerce
- Apply methods in case studies

**Social competence**
The students:

- Develop case studies on basis of given problems in groups
- Present their solutions

**Self-competence**
The students:

- Learn about their own limitations while planning and developing e-commerce applications

#### Module contents

The module provides the following contents:

- The definition of the core e-business concepts and the technical conditions for the implementation
- Introduction of the variations of e-commerce, especially the Business-to-Consumer (B2C) and Business-2-Business (B2B) concepts and the current research in this field
- Discussion on the economic aspects of e-business based on the theory of informational added value
- Technological basics of the web and current development technologies for e-commerce web
applications and security mechanisms with focus on online-shops and applications (hands-on exercise topics: HTTP, JSP and SQLInjection, PHP, XML, XML-Security, data modelling, Online-Shop development and Online-Shop administration)

Reader's advisory


Links
http://www.wi-ol.de/

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Modullevel
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Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
V & Ü

Vorkenntnisse / Previous knowledge

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Total time of attendance for the module
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## inf610 - Enterprise Architecture Management

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<td>Axel Hahn</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>This module adresses basic elements of enterprise architectures and their management as well as concepts and methodologies used to describe and develop enterprise architectures.</td>
</tr>
<tr>
<td>Professional competences</td>
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</tr>
<tr>
<td></td>
<td>Have knowledge of components of enterprise architectures and used enterprise architecture frameworks</td>
</tr>
<tr>
<td></td>
<td>Choose Enterprise Architecture Frameworks based on requirements and needs</td>
</tr>
<tr>
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<td>The students:</td>
</tr>
<tr>
<td></td>
<td>Identify business goals and describe the resulting business processes</td>
</tr>
<tr>
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<td>Design fitting IT-architectures</td>
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<tr>
<td></td>
<td>Analyze and harmonize different architectures into an enterprise architecture</td>
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<tr>
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</tr>
<tr>
<td></td>
<td>Extend their ability to work as a team</td>
</tr>
<tr>
<td></td>
<td>Create, present and discuss exercises using EAM methods</td>
</tr>
<tr>
<td></td>
<td>Identify and solve problems and challenges in the harmonization of enterprise architectures using EAM methods</td>
</tr>
<tr>
<td>Self-competences</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>Reflect their actions in identifying possible solutions using EAM methods</td>
</tr>
<tr>
<td></td>
<td>Learn methodical and scientific procedures in the processing of accompanying exercises</td>
</tr>
<tr>
<td></td>
<td>Develop the ability to look at different aspects of systems in a superordinate and common (company) context, including the methods of EAM.</td>
</tr>
<tr>
<td>Module contents</td>
<td>Enterprise Architecture Management (EAM) is an interdisciplinary approach for the integration of information systems in enterprises and enterprise-like structures to support their business objectives and business processes. EAM addresses the harmonization of these aspects on the basis of the respective IT-architecture and business architectures to a holistic enterprise architecture. The description and development of such architectures is structured by Enterprise Architecture Frameworks like TOGAF and ZACHMAN. In general, the following architectural perspectives are taken into account: business architecture, information and data architecture, application architecture and technology architecture.</td>
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<tr>
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<tr>
<td></td>
<td>Strategisches Management der IT-Landschaft Ein praktischer Leitfaden für das Enterprise Architecture Management – Inge Hanschke - 978-3-446-43509-4</td>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>Oral examination or written examination at the end of the semester</td>
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<td>With an appropriate number of participants (&lt;12 students), an oral examination will be held. In case of a high number of participants (&gt;12 students), an exam will be held instead. It counts the number of participants in the Stud.IP at the beginning of the first course. Exercises are issued during the semester, the successful completion of them is credited to the examination with a maximum total of 10% bonus.</td>
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inf700 - Computer Science Education I

Module label: Computer Science Education I
Module code: inf700
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Zwei-Fächer-Bachelor Informatik > Aufbaumodule
- Zwei-Fächer-Bachelor Informatik > Basismodule

Contact person:
Module responsibility:
- Ira Diethelm

Authorized examiners:
- Ira Diethelm
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:

Professional competence:
The students:
- characterise the different computer science education (CSE) concepts and approaches, e.g. the early approaches of CSE in school or the concept of computer science (CS) in contexts
- select and discuss teaching subjects by analysing didactic approaches and concepts
- describe the general education character of CS
- compare the different approaches and concepts of CSE and are able to illustrate common features and contradictions
- reflect lesson subjects by the approaches and topics of CSE

Methodological competence:
The students:
- link the concepts and approaches of CSE with the educational reconstruction
- classify the similarities and differences of the concepts and approaches of CSE academically

Social competence:
The students:
- discuss the concepts and approaches of CSE with students and lectures academically
- accept the thoughts of other students and lectures
- give and accept criticism objectively

Self-competence:
The students:
- integrate the concepts and approaches of CSE into their planning and operations
- reflect their self-perception with regard to the concepts and approaches of CSE

Module contents:
The field of CSE is introduced by this module. Different CSE approaches and concepts are presented. These CSE approaches and concepts are, e.g.:

- early concepts of CS in schools
- general education character of CS
- idea oriented approach of CSE
- information centred approach of CSE
- CSE in elementary school
- system oriented approach

Subjects like „CS projects in class“ are also part of this module.

Reader's advisory:
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<td>Modulart</td>
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<td>Lern-/Lehrform / Type of program</td>
<td>V &amp; Ü</td>
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### inf803 - Special Topics in Computer Science I

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#### Used in course of study
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Master of Education (Wirtschaftspädagogik) Informatik > Praktische Vertiefung der Informatik
- Zwei-Fächer-Bachelor Informatik > Praktische Vertiefung

#### Contact person
- Module responsibility
  - Die im Modul Lehrenden
  - Authorized examiners
  - Die im Modul Lehrenden

#### Contact person

### Entry requirements

**Skills to be acquired in this module**

**Professional competence**
The students:

- Know recent technological or scientific computer science developments
- Transfer computer science methods and development models to IT application area requirements
- Evaluate the possibilities and limitations of computer science methods and tools and apply them appropriately

**Methodological competence**
The students:

- Review problems, formulate them with formal models and explore them appropriately
- Identify and present (one or more) computer science problem solutions
- Select and evaluate appropriate tools and methods
- Examine problems with technical and scientific literature

**Social competence**
The students:

- Work in a team

**Self-competence**
The students:

- Plan their informatical actions independently

### Module contents
According to the assigned task

### Reader's advisory
According to the assigned task

### Languages of instruction
German, English

### Duration (semesters)
1 Semester

### Module frequency
halbjährlich

### Module capacity
unlimited

### Module level
---

### Modulart
je nach Studiengang Pflicht oder Wahlpflicht

### Lern-/Lehrform / Type of program
2 courses out of VL, Ü, Tut, SE, PR

### Vorkenntnisse / Previous knowledge

### Examination

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Course selection
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**inf804 - Special Topics in Computer Science II**

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</tr>
<tr>
<td></td>
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**Entry requirements**

**Skills to be acquired in this module**  
This module integrates current computer science developments within appropriate study courses.

**Professional competence**

The students:

- Know recent technological or scientific computer science developments
- Transfer computer science methods and development models to IT application area requirements
- Evaluate the possibilities and limitations of computer science methods and tools and apply them appropriately

**Methodological competence**

The students:

- Review problems, formulate them with formal models and explore them appropriately
- Identify and present (one or more) computer science problem solutions
- Select and evaluate appropriate tools and methods
- Examine problems with technical and scientific literature

**Social competence**

The students:

- Work in a team

**Self-competence**

The students:

- Plan their informatical actions independently

**Module contents**  
According to the assigned task

**Reader's advisory**  
According to the assigned task

**Languages of instruction**  
German, English

**Duration (semesters)**  
1 Semester

**Module frequency**  
hälbjährlich

**Module capacity**  
unlimited

**Modullevel**  
---

**Modulart**  
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**  
2 courses out of VL, Ü, Tut, SE, PR

**Vorkenntnisse / Previous knowledge**

**Examination**  
Time of examination  
Type of examination

**Final exam of module**  
Exercises or presentation or oral exam or written exam

**Course type**  
Course selection
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inf805 - Special Topics in Computer Science III

Module label: Special Topics in Computer Science III
Module code: inf805
Credit points: 6.0 KP
Workload: 180 h

Used in course of study: Fach-Bachelor Informatik > Akzentsetzungsmodul

Contact person:
Module responsibility: Die im Modul Lehrenden
Authorized examiners: Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module: This module integrates current computer science developments within appropriate study courses.

Professional competence
The students:
- Know recent technological or scientific computer science developments
- Transfer computer science methods and development models to IT application area requirements
- Evaluate the possibilities and limitations of computer science methods and tools and apply them appropriately

Methodological competence
The students:
- Review problems, formulate them with formal models and explore them appropriately
- Identify and present (one or more) computer science problem solutions
- Select and evaluate appropriate tools and methods
- Examine problems with technical and scientific literature

Social competence
The students:
- Work in a team

Self-competence
The students:
- Plan their informatical actions independently

Module contents: According to the assigned task
Reader's advisory: According to the assigned task

Links
Languages of instruction: German, English
Duration (semesters): 1 Semester
Module frequency: halbjährlich
Module capacity: unlimited
Modulelevel: ---

Modular
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program: 2 courses out of VL, Ü, Tut, SE, PR

Vorkenntnisse / Previous knowledge
Examination: Time of examination

Final exam of module: Exercises or presentation or oral exam or written exam

Course type: Course selection
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inf806 - Special Topics in Computer Science IV

Module label: Special Topics in Computer Science IV
Module code: inf806
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodule

Contact person:
- Module responsibility
  - Die im Modul Lehrenden
- Authorized examiners
  - Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:
This module integrates current computer science developments within appropriate study courses.

Professional competence
The students:
- Know recent technological or scientific computer science developments
- Transfer computer science methods and development models to IT application area requirements
- Evaluate the possibilities and limitations of computer science methods and tools and apply them appropriately

Methodological competence
The students:
- Review problems, formulate them with formal models and explore them appropriately
- Identify and present (one or more) computer science problem solutions
- Select and evaluate appropriate tools and methods
- Examine problems with technical and scientific literature

Social competence
The students:
- Work in a team

Self-competence
The students:
- Plan their informatical actions independently

Module contents:
According to the assigned task

Reader's advisory:
According to the assigned task

Links:

Languages of instruction:
German, English

Duration (semesters):
1 Semester

Module frequency:
halbjährlich

Module capacity:
unlimited

Modullevel:
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Modular:
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program:
2 courses out of VL, Ü, Tut, SE, PR

Vorkenntnisse / Previous knowledge:

Examination:

Time of examination

Type of examination

Final exam of module:
Exercises or presentation or oral exam or written exam

Course type:
Course selection
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**inf807 - Special Topics in Computer Science V**

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**Entry requirements**

**Skills to be acquired in this module**

This module integrates current computer science developments within appropriate study courses.

**Professional competence**

The students:

- Know recent technological or scientific computer science developments
- Transfer computer science methods and development models to IT application area requirements
- Evaluate the possibilities and limitations of computer science methods and tools and apply them appropriately

**Methodological competence**

The students:

- Review problems, formulate them with formal models and explore them appropriately
- Identify and present (one or more) computer science problem solutions
- Select and evaluate appropriate tools and methods
- Examine problems with technical and scientific literature

**Social competence**

The students:

- Work in a team

**Self-competence**

The students:

- Plan their informatical actions independently

**Module contents**

According to the assigned task

**Reader's advisory**

According to the assigned task

**Languages of instruction**

German, English

**Duration (semesters)**

1 Semester

**Module frequency**

halbjährlich

**Module capacity**

unlimited

**Modulart**

---

**Lern-/Lehrform / Type of program**

2 courses out of VL, Ü, Tut, SE, PR

**Vorkenntnisse / Previous knowledge**

**Examination**

Type of examination

Final exam of module

Exercises or presentation or oral exam or written exam

**Course type**

Course selection
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**inf808 - Current Topics in Computer Science**

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<tr>
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<tr>
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<td>Evaluate the possibilities and limits of computer science methods and tools and apply them appropriately</td>
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<td>The students:</td>
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<td>Review problems, formulate them with formal models and explore them appropriately</td>
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<td>Identify and present (one or more) computer science problem solutions</td>
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<td>Select and evaluate appropriate tools and methods</td>
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<tr>
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<td>Reflect on a scientific topic and write a scientific seminar paper under guidance and present their findings</td>
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<td>Social competence</td>
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<td>Use presentation methods purposefully</td>
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<td>Plan their informatical actions independently</td>
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<td>Reflect their contributions critically and discuss them with users and experts</td>
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<td>Collect and update their knowledge independently</td>
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<p>| Module contents       | According to the assigned task |
| Reader's advisory     | According to the assigned task |
| Links                |                                    |
| Language of instruction | German                           |
| Duration (semesters)  | 1 Semester                        |
| Module frequency      | unregelmäßig                     |
| Module capacity       | unlimited                         |
| Modulart              | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program | 1 course out of VL, SE, PR |
| Vorkenntnisse / Previous knowledge |                                    |
| Examination           |                                    |
| Time of examination   |                                    |
| Type of examination   |                                    |
| Final exam of module  | Exercises or presentation or oral exam or written |</p>
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**Course type**
- Course selection

**SWS**
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**Frequency**
- SuSe and WiSe

**Workload attendance**
- 28 h
# inf852 - Project Management in IT

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<tr>
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<tr>
<td>Workload</td>
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</tbody>
</table>

**Used in course of study**

- Fach-Bachelor Betriebswirtschaftslehre für Leistungssportlerinnen und Leistungssportler > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Betriebswirtschaftslehre mit juristischem Schwerpunkt > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Biologie > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Business Administration in mittelständischen Unternehmen > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Chemie > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Comparative and European Law > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Engineering Physics > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Informatik > Akzentsetzungsmodule
- Fach-Bachelor Informatik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Interkulturelle Bildung und Beratung > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Mathematik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Pädagogik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Technologie > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Physik, Technik und Medizin > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Sozialwissenschaften > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Umweltwissenschaften > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Wirtschaftswissenschaften > Praxismodule für Studierende mit außerschulischem Berufsziel
- Fach-Bachelor Wirtschaftswissenschaften > Studienrichtung Wirtschaftsinformatik
- Zwei-Fächer-Bachelor Anglistik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Biologie > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Chemie > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Elementarmathematik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Ev. Theologie und Religionspädagogik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Gender Studies > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Germanistik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Geschichte > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Informatik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Interdisziplinäre Sachbildung > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Kunst und Medien > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Materiele Kultur: Textil > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Mathematik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Musik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Niederländistik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Ökonomische Bildung > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Pädagogik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Philosophie / Werte u. Normen > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Politik-Wirtschaft > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Slawistik > Praxismodule für Studierende mit außerschulischem Berufsziel
- Zwei-Fächer-Bachelor Sozialwissenschaften > Praxismodule für Studierende mit außerschulischem Berufsziel
Zwei-Fächer-Bachelor Sportwissenschaft > Praxismodule für Studierende mit außerschulischem Berufsziel
Zwei-Fächer-Bachelor Technik > Praxismodule für Studierende mit außerschulischem Berufsziel
Zwei-Fächer-Bachelor Wirtschaftswissenschaften > Praxismodule für Studierende mit außerschulischem Berufsziel

Contact person
Module responsibility
- Jürgen Sauer

Authorized examiners
- Jürgen Sauer
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module
The participants of this course are aware of problems, activities and tools of data processing project management (DP-Project-Management). They are able to identify and select the corresponding tools in different project stages and are familiar with those tools. They are able to describe the business informatics fields of actions. The are competent to work in a team and organise and implement projects.

Professional competence
The students:
- Characterise problems, activities and tools of the data processing project management.
- Are able to identify the corresponding tools in different project stages
- Use specific DP-Project-Management tools
- Differentiate the business informatics field of actions

Methodological competence
The students:
- Perform projects with the tools of each phase

Social competence
The students:
- Work in small project-teams
- Make design decisions cooperatively
- Present solutions

Self-competence
The students:
- Acquire DP-Project-Management methods and use them
- Recognise and are responsible for working packages

Module contents
It is important to know different IT project management types and forms as well as corresponding methods and tools. This course provides basic data-processing problems, activities and methods. The course is based on M. Burghardt's book. After an introduction, the course is divided as follows:
- Project management (Requirements Engineering, Profitability Analysis, Organisational Structure)
- Project Planning (Project Structure, Network Analysis, Project Plans)
- Project Control (Cost Evaluation, Quality Control)
- Project Completion

The participants get familiar with project management tools. Presentations drawn from practice are intended.

Reader's advisory

Links
www.wi-ol.de

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Modullevel
---

Modulart
je nach Studiengang Pflicht oder Wahlpflicht
<table>
<thead>
<tr>
<th>Lern-Lehrform / Type of program</th>
<th>V &amp; Ü</th>
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<tbody>
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<td>Vorkenntnisse / Previous knowledge</td>
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<tr>
<td>Final exam of module</td>
<td>At the end of the lecture period</td>
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<tr>
<td>Course type</td>
<td>Comment</td>
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<td>Exercises</td>
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<td><strong>Total time of attendance for the module</strong></td>
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inf853 - Application Fields of Computer Science I

Module label: Application Fields of Computer Science I
Module code: inf853
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodul

Contact person:
Module responsibility:
- Die im Modul Lehrenden

Authorized examiners:
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:
The students are introduced into a different subject area and its methods.

**Professional competence**
The students:

- Know a computer science application area
- Transfer computer science methods and development models to/with IT application area requirements

**Methodological competence**
The students:

- Know and name ways of thinking and methods of other subject areas

**Social competence**
The students:

- Communicate considerately and appropriately with users and experts

**Self-competence**
The students:

- Plan their informatical actions independently
- Reflect their contributions critically and discuss them with users and experts

Module contents:
According to the assigned task

Reader's advisory:
According to the assigned task

Links:

Languages of instruction:
German, English

Duration (semesters):
1 Semester

Module frequency:
unregelmäßig

Module capacity:
unlimited

Modullevel:
---

Modulart:
jeder nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program:
2 courses out of VL, Ü, S, P, PR

Vorkenntnisse / Previous knowledge:

Examination:

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<tr>
<th>Examination</th>
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<th>Type of examination</th>
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<td>Exercises or presentation or oral exam or written exam</td>
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Course type:
Course selection

SWS:
4.00

Frequency:
SuSe or WiSe
| Workload attendance | 56 h |


### inf854 - Application Fields of Computer Science II

<table>
<thead>
<tr>
<th>Module label</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Workload</td>
<td>180 h</td>
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</tbody>
</table>
| Used in course of study      | Fach-Bachelor Informatik > Akzentsetzungsmodule  
                                 Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodule |
| Contact person               | Module responsibility                       |
|                              | - Die im Modul Lehrenden                   |
|                              | Authorized examiners                       |
|                              | - Die im Modul Lehrenden                   |
| Entry requirements           | The students are introduced into a different subject area and its methods. |
| Skills to be acquired in this module | Professional competence | The students: |
|                              | - Know a computer science application area |
|                              | - Transfer computer science methods and development models to/with IT application area requirements |
|                              | Methodological competence                  |
|                              | - Know and name ways of thinking and methods of other subject areas |
|                              | Social competence                          |
|                              | - Communicate considerately and appropriately with users and experts |
|                              | Self-competence                            |
|                              | - Plan their informatical actions independently |
|                              | - Reflect their contributions critically and discuss them with users and experts |
| Module contents              | According to the assigned task             |
| Reader's advisory            | According to the assigned task             |
| Links                        |                                            |
| Languages of instruction     | German, English                            |
| Duration (semesters)         | 1 Semester                                 |
| Module frequency             | halbjährlich                               |
| Module capacity              | unlimited                                  |
| Modullevel                   | ---                                       |
| Modulart                     | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program | 2 courses out of VL, Ü, S, P, PR         |
| Vorkenntnisse / Previous knowledge |                                            |
| Examination                  | Time of examination                        |
| Final exam of module         | Type of examination                        |
| Course type                  | Course selection                           |
| SWS                          | 4.00                                      |
| Frequency                    | SuSe or WiSe                              |
| Workload attendance | 56 h |
**inf855 - Application Fields of Computer Science III**

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<td><strong>Workload</strong></td>
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| **Used in course of study** | Fach-Bachelor Informatik > Akzentsetzungsmodulle  
|                  | Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodulle |
| **Contact person** | Module responsibility  
|                  | Die im Modul Lehrenden  
|                  | Authorized examiners  
|                  | Die im Modul Lehrenden |

**Entry requirements**

**Skills to be acquired in this module**

The students are introduced into a different subject area and its methods.

--- **Professional competence**

The students:

- Know a computer science application area
- Transfer computer science methods and development models to/with IT application area requirements

--- **Methodological competence**

The students:

- Know and name ways of thinking and methods of other subject areas

--- **Social competence**

The students:

- Communicate considerately and appropriately with users and experts

--- **Self-competence**

The students:

- Plan their informatical actions independently
- Reflect their contributions critically and discuss them with users and experts

**Module contents**

According to the assigned task

**Reader's advisory**

According to the assigned task

**Links**

**Languages of instruction**

German, English

**Duration (semesters)**

1 Semester

**Module frequency**

halbjährlich

**Module capacity**

unlimited

**Modulelevel**

---

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**

2 courses out of VL, Ü, S, P, PR

**Vorkenntnisse / Previous knowledge**

**Examination**

Time of examination

Type of examination

**Final exam of module**

Exercises or presentation or oral exam or written exam

**Course type**

Course selection

**SWS**

4.00

**Frequency**

SuSe and WiSe
| Workload attendance | 56 h |
inf856 - Application Fields of Computer Science IV

Module label: Application Fields of Computer Science IV
Module code: inf856
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Akzentsetzungsmodul
- Fach-Bachelor Wirtschaftsinformatik > Akzentsetzungsmodul

Contact person:
Module responsibility:
- Die im Modul Lehrenden
Authorized examiners:
- Die im Modul Lehrenden

Entry requirements:
Skills to be acquired in this module:
The students are introduced into a different subject area and its methods.

Professional competence:
The students:
- Know a computer science application area
- Transfer computer science methods and development models to/with IT application area requirements

Methodological competence:
The students:
- Know and name ways of thinking and methods of other subject areas

Social competence:
The students:
- Communicate considerately and appropriately with users and experts

Self-competence:
The students:
- Plan their informatical actions independently
- Reflect their contributions critically and discuss them with users and experts

Module contents:
According to the assigned task

Reader's advisory:
According to the assigned task

Links:
Languages of instruction: German, English
Duration (semesters): 1 Semester
Module frequency: halbjährlich
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program:
2 courses out of VL, Ü, S, P, PR

Vorkenntnisse / Previous knowledge:

Examination:
Type of examination:
- Exercises or presentation or oral exam or written exam

Final exam of module:

Course type:
Course selection

SWS: 4.00

Frequency:
SuSe and WiSe
| Workload attendance | 56 h |
**inf857 - Application Fields of Computer Science V**

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<td>Skills to be acquired in this module</td>
<td><a href="#">Professional competence</a>  <a href="#">Methodological competence</a>  <a href="#">Social competence</a>  <a href="#">Self-competence</a></td>
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<tr>
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<tr>
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<td>The students:</td>
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<td>Self-competence</td>
<td>The students:</td>
</tr>
<tr>
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<td>• Plan their informatical actions independently</td>
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<td>• Reflect their contributions critically and discuss them with users and experts</td>
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<td>Reader's advisory</td>
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<tr>
<td>Lern-/Lehrform / Type of program</td>
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Abschlussmodul
bam - Bachelor Thesis and Colloquium

Module label
Bachelor Thesis and Colloquium

Module code
bam

Credit points
15.0 KP

Workload
450 h

Used in course of study
- Fach-Bachelor Informatik > Abschlussmodul

Contact person
Module responsibility
- Die im Modul Lehrenden

Authorized examiners
- Die Modulverantwortlichen
- Die im Modul Lehrende

Module counseling
- Die im Modul Lehrenden

Entry requirements
Skills to be acquired in this module
The students are able to process and write on a scientifically oriented computer science topic.

Professional competence
The students:
- Evaluate the possibilities and limits of computer science methods and tools and apply them appropriately

Methodological competence
The students:
- Select appropriate methods and tools and evaluate them
- Analyse problems using the latest technical and scientific literature
- Implement software projects and design hardware with the latest computer science tools
- Reflect a (computer) science topic under guidance, write an article (seminar paper or thesis) and present their results scientifically

Social competence
The students:
- Recognise conflicts and solve them in a team
- Use presentation and project management methods appropriately
- Identify and assume responsibility for tasks
- Are aware of the social impact of their computational/informatical actions, as well as the consequences of information technologies

Self-competence
The students:
- Select priorities appropriately, also their own
- Plan their computer science actions independently
- Complement and deepen their knowledge and adapt it to the latest developments in IT independently
- Evaluate their results and discuss them with users and experts

Module contents
A state-of-the-art computer science topic is processed theoretically, scientifically and practically. The student presents the results.

Reader's advisory
According to the topic

Links
https://www.uni-oldenburg.de/informatik/studium-lehre/infos-zum-studium/abschlussarbeiten/

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited
<table>
<thead>
<tr>
<th>Modullevel</th>
<th>Abschlussmodul (Abschlussmodul)</th>
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<tbody>
<tr>
<td>Modulart</td>
<td>Pflicht</td>
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<td>SE</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<tr>
<td>Examination</td>
<td>Time of examination</td>
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Wahlpflichtbereich Mathematik

mat030 - Analysis IIa: Integration in One Variable and Differential Equations

<table>
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<tr>
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<td>Credit points</td>
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<tr>
<td>Workload</td>
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</tr>
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Used in course of study
- Fach-Bachelor Informatik > Wahlpflichtbereich Mathematik
- Fach-Bachelor Mathematik > Basismodule
- Fach-Bachelor Physik > Aufbaumodule
- Zwei-Fächer-Bachelor Mathematik > Basismodule

Contact person
- Module responsibility
  - Andreas Defant
  - Daniel Grieser
  - Ivan Shestakov
  - Hannes Uecker
  - Boris Vertman

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Language of instruction | German
Duration (semesters) | 1 Semester

Module frequency

Module capacity | unlimited

Modulart | je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination

Type of examination

Final exam of module

Course type | Comment | SWS | Frequency | Workload attendance |
--- | --- | --- | --- | --- |
Lecture | 2.00 | SuSe | 28 h |
Exercises | 2.00 | SuSe | 28 h |

Total time of attendance for the module | 56 h |
## mat200 - Algebra I: Rings and Modules

<table>
<thead>
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<th>Algebra I: Rings and Modules</th>
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<tbody>
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<td><strong>Credit points</strong></td>
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<tr>
<td><strong>Workload</strong></td>
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</table>
| **Used in course of study** | - Fach-Bachelor Informatik > Wahlpflichtbereich Mathematik  
|                   | - Zwei-Fächer-Bachelor Mathematik > Aufbaumodule  |

### Contact person

**Module responsibility**
- Florian Heß
- Andreas Stein

### Entry requirements

### Skills to be acquired in this module

### Module contents

### Reader’s advisory

### Links

### Language of instruction
German

### Duration (semesters)
1 Semester

### Module frequency

### Module capacity
unlimited

### Module level
---

### Modulart
je nach Studiengang Pflicht oder Wahlpflicht

### Lern-/Lehrform / Type of program

### Vorkenntnisse / Previous knowledge

### Examination

<table>
<thead>
<tr>
<th><strong>Time of examination</strong></th>
<th><strong>Type of examination</strong></th>
</tr>
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<tbody>
<tr>
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### Course type

<table>
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<th><strong>Course type</strong></th>
<th><strong>Comment</strong></th>
<th><strong>SWS</strong></th>
<th><strong>Frequency</strong></th>
<th><strong>Workload attendance</strong></th>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>4.00</td>
<td></td>
<td>56 h</td>
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<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td></td>
<td>28 h</td>
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### Total time of attendance for the module
84 h
mat310 - Statistics I – Introduction to Applied Statistics

Module label: Statistics I – Introduction to Applied Statistics
Module code: mat310
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Fach-Bachelor Informatik > Wahlpflichtbereich Mathematik
- Fach-Bachelor Mathematik > Vertiefungsmodule

Contact person:
- Module responsibility:
  - Marcus Christiansen
  - Angelika May
  - Peter Ruckdeschel

Entry requirements:

Skills to be acquired in this module:

Module contents:

Reader's advisory:

Links:

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: ---
Module capacity: unlimited

Lern-/Lehrform / Type of program:

Vorkenntnisse / Previous knowledge:

Examination:

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<tr>
<td>Exercises</td>
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Total time of attendance for the module: 56 h
**mat996 - Introduction to Numerical Analysis**

<table>
<thead>
<tr>
<th>Module label</th>
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<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Workload</td>
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<td>Used in course of study</td>
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  - Fach-Bachelor Informatik > Wahlpflichtbereich Mathematik  
  - Fach-Bachelor Wirtschaftsinformatik > Aufbaumodule  
  - Master Informatik > Nicht Informatik |
| Contact person | Module responsibility  
  - Alexey Chernov  
  - Frank Schöpfer |

**Entry requirements**

The students learn and analyze the basic numerical methods. The students learn to implement the basic numerical methods in a computer program.

**Professional competence**

The students:
- learn basic numerical methods and algorithms
- analyze properties of the numerical methods using rigorous mathematical tools
- implement the basic numerical methods in a computer program
- interpret results of computer simulations

**Methodological competence**

The students:
- analyze algorithms with mathematical tools
- implement numerical algorithms for concrete problems

**Social competence**

The students:
- develop solutions to given problems in groups
- accept constructive criticism

**Personal competence**

The students:
- reflect their solution strategies
- deepen their understanding of the presented mathematical and algorithmical concepts with exercises and adopt the solution methods

**Module contents**

- Numerical methods for linear systems: LU-, Cholesky decompositions, iterative methods
- Numerical methods for nonlinear equations: fix-point iterations, Newton's Method
- Polynomials, spline and trigonometric interpolation
- Numerical integration: Newton-Cotes, Gauss quadrature rules, adaptive quadrature and extrapolation methods
- Stability and conditioning of algorithms and problems

**Reader's advisory**


**Links**

<table>
<thead>
<tr>
<th>Language of instruction</th>
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<tbody>
<tr>
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<tr>
<td>Module frequency</td>
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<td>Module capacity</td>
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<td>Modullevel</td>
<td>AS (Akzentsetzung / Accentuation)</td>
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<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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**VorKenntnisse / Previous knowledge**

Analysis I, Lineare Algebra

**Examination**

<table>
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<tr>
<th>Examination</th>
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<tbody>
<tr>
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<td>At the end of the lecture period written exam</td>
<td>Final exam of module</td>
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**Course type**

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**Total time of attendance for the module** 56 h
mat997 - Introduction to Probability and Statistics

<table>
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<tr>
<th>Module label</th>
<th>Introduction to Probability and Statistics</th>
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<tbody>
<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
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| Used in course of study | • Fach-Bachelor Informatik > Wahlpflichtbereich Mathematik  
  • Master Informatik > Nicht Informatik |
| Contact person        | Module responsibility                               |
|                       | • Peter Krug                                         |

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

Languages of instruction

Duration (semesters) 1 Semester

Module frequency

Module capacity unlimited

Modulart je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination Time of examination Type of examination

Final exam of module

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<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
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<td>28 h</td>
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Total time of attendance for the module 56 h
mat995 - Special Topics in Mathematics

Module label  Special Topics in Mathematics
Module code  mat995
Credit points  6.0 KP
Workload  180 h
Used in course of study  • Fach-Bachelor Informatik > Wahlpflichtbereich Mathematik
Contact person  Module responsibility
  ○ Oliver Theel
  ○ Andreas Defant
  ○ Alexey Chernov
  ○ Daniel Grieser
  ○ Peter Krug
  ○ Frank Schöpfer
  ○ Hannes Uecker

Entry requirements
Skills to be acquired in this module
Module contents
Reader's advisory
Links
Language of instruction  German
Duration (semesters)  1 Semester
Module frequency
Module capacity  unlimited
Modullevel  ---
Modulart  je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge
Final exam of module
Type of examination
Course type  Comment  SWS  Frequency  Workload attendance
Lecture  2.00
Exercises  2.00
Total time of attendance for the module  56 h