## Mastermodule

### inf006 - Software Engineering II

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<tr>
<th>Module label</th>
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<tr>
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<td>Workload</td>
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**Verwendbarkeit des Moduls**
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule

**Zuständige Personen**
- Winter, Andreas (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
- 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

**Literatureempfehlungen**

- 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
- **Modullevel / module level**: AS (Akzentsetzung / Accentuation)
- **Modulart / typ of module**: je nach Studiengang Pflicht oder Wahlpflicht
- **Lehr-/Lernform / Teaching/Learning method**: V+S
- **Vorkenntnisse / Previous knowledge**: Softwaretechnik I
- **Examination**: Prüfungszeiten
  - **Final exam of module**: At the end of the lecture period
    - Portfolio (30-minute presentation, 1 paper (4 pages, IEEE) and oral exam)

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**Präsenzzeit Modul insgesamt**: 56 h
inf007 - Information Systems I

Module label  Information Systems I
Modulkürzel inf007
Credit points  6.0 KP
Workload  180 h

Verwendbarkeit des Moduls
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum - Pflichtbereich
- Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Master Applied Economics and Data Science (Master) > Specialization
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Grawunder, Marco (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module
This module introduces the core concepts, languages and architectures of databases. In software systems these concepts are important.

Professional competence
The students:
- name the core concepts of the languages and architectures of databases (especially)
- select data models
- integrate structuring concepts of information systems in their designs

Methodological competence
The students:
- design database systems appropriately
- analyse problems from the field of database-supported information systems and solve them appropriately

Social competence
The students:
- enhance their ability to work in a team

Self-competence
The students:
- reflect their problem-solving behaviour with regard to the information processing concepts

Module contents
- Relational data models
- Relational algebra and its implementation in SQL (the standard of databases)
- Database design on different abstractions (conceptual and logical design)
- Normalisation
- Data base architectures
- Distributed and active databases
- Object-oriented, object-related and XML-based database systems

Literaturempfehlungen

Links
Language of instruction  German
Duration (semesters)  1 Semester
Module frequency  jährlich
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**Vorkenntnisse / Previous knowledge**

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**Final exam of module**

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inf010 - Computer Networks

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik
- Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Mastermodule

**Zuständige Personen**

Kramer, Oliver (Prüfungsberechtigt)

Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**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 ISO/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 administraiton 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 & Dijkstra
- IP Addressing & Header
- TCP
- UDP
- Buckets & TCP-Reno
- DNS
- Flask
- RSA & PGP
- Firewalls
Literaturrempfehlungen

- 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 / module level
AM (Aufbaumodul / Composition)

Module art / type of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning Method
V+Ü

Vorkenntnisse / Previous knowledge

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Form of teaching

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Präsenzzeit Modul insgesamt

56 h
inf012 - Operating Systems I

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik
- Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

**Zuständige Personen**
- Theel, Oliver (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
- To gain knowledge of and capabilities in the design, the implementation, and the evaluation of operating systems.

**Skills to be acquired in this module**

**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

**Literaturempfehlungen**

**Links**
- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
**Reference text**

Verknüpft mit den Modulen:

- Betriebssysteme II (als mögliche Anschlussveranstaltung)
- Verteilte Betriebssysteme (als mögliche Spezialisierung)
- Betriebssysteme-Praktikum

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**inf015 - Distributed Operating Systems**

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

**Zuständige Personen**
- Theel, Oliver (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
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

Literaturempfehlungen


Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Reference text: Associated with the modules:

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

Modullevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method: V+Ü
Vorkenntnisse / Previous knowledge: Betriebssysteme I
Examination: Prüfungszeiten
Type of examination:
Final exam of module: End of the lecture period
Training tasks, written exam or oral exam
Form of teaching: Comment
SWS Frequency Workload of compulsory attendance
Lecture: 2 SoSe 28
Exercises: 2 SoSe 28
Präsenzzeit Modul insgesamt: 56 h
inf016 - Internet Technologies

Module label | Internet Technologies
Modulkürzel | inf016
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Boll-Westermann, Susanne (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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.

Literaturempfehlungen
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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## Module label

Interactive Systems

## Modulkürzel

inf017

## Credit points

6.0 KP

## Workload

180 h

### Verwendbarkeit des Moduls

- Bachelor's Programme Biology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Business Administration and Law (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Business Informatics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Chemistry (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Comparative and European Law (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Bachelor's Programme Computing Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Economics and Business Administration (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Engineering Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Environmental Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Mathematics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Social Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Sustainability Economics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Biology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Economics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
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Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Social Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Sport Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Dual-Subject Bachelor's Programme Technology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen

Boll-Westermann, Susanne (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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.

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

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Modulelevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
Wahlpflicht / Elective
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Präsenzzelt Modul insgesamt 56 h
### inf018 - Media Processing

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**Verwendbarkeit des Moduls**

- Bachelor's Programme Biology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Business Administration and Law (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Business Informatics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Chemistry (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer" more...
- Bachelor's Programme Comparative and European Law (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Bachelor's Programme Computing Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Economics and Business Administration (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Engineering Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Environmental Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Mathematics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Social Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Bachelor's Programme Sustainability Economics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Biology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Praktische Vertiefung (60 KP)
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
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- Dual-Subject Bachelor's Programme History (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > PP "Medieninformatik für
### Prerequisites

**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.

### Literatureempfehlungen

- 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 / module level

AS (Akzentsetzung / Accentuation)

### Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

### Lehr-/Lernform / Teaching/Learning method

V+P

### Vorkenntnisse / Previous knowledge

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<td>At the end of the lecture period</td>
<td>Project and oral exam</td>
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Zuständige Personen

Boll-Westermann, Susanne (Prüfungsberechtigt)

Lehrenden, Die im Modul (Prüfungsberechtigt)
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inf019 - Compiler Construction

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<td>Verwendbarkeit des Moduls</td>
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<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>• name the structure of a compiler and each part of the compiling process of a programming language</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></td>
</tr>
<tr>
<td></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>
</tbody>
</table>

Module contents

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.

Literaturempfehlungen

Essential:

• Handout

Recommended:


Links

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Präsenzzeit Modul insgesamt 56 h
inf020 - Machine-oriented Programming

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Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
- Theel, Oliver (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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.

Literatureempfehlungen
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**inf202 - Computer Engineering Practical**

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### Verwendbarkeit des Moduls

- Bachelor's Programme Biology (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Business Administration and Law (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Business Informatics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Chemistry (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Comparative and European Law (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Computing Science (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Engineering Physics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Environmental Science (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Intercultural Education and Counseling (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Intercultural Education and Counseling (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Mathematics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Physics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Physics, Engineering and Medicine (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Social Studies (Bachelor) > Fachnahe Angebote Informatik
- Bachelor’s Programme Sustainability Economics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Art and Media (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Biology (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Chemistry (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Computing Science (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Computing Science (Bachelor) > Praktische Vertiefung (60 KP)
- Dual-Subject Bachelor’s Programme Dutch Linguistics and Literary Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Economic Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Elementary Mathematics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme English Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Gender Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme General Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme German Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme History (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Material Culture: Textiles (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Mathematics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Music (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Philosophy / Values and Norms (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Physics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Politics-Economics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Protestant Theology and Religious Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Slavic Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Social Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Special Needs Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Sport Science (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor’s Programme Technology (Bachelor) > Fachnahe Angebote Informatik
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > Fachnahe Angebote Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Praktische Vertiefung der Informatik

### Zuständige Personen

- Mikschl, Alfred (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

### Prerequisites

Empfehlung: inf200 „Grundlagen der Technischen Informatik“
Skills to be acquired in this module

Diese Veranstaltung versetzt die Studierenden in die Lage, informationstechnische Systeme zu analysieren, einzelne Komponenten von Rechnern zu verstehen, sie zu entwerfen und zu optimieren sowie qualifiziert über domänspezifischen Hardwareentwurf zu diskutieren.

Fachkompetenz:
Die Studierenden

- beschreiben einzelne Komponenten von Rechnern
- entwerfen und optimieren einzelne Komponenten von Rechnern
- entwerfen und optimieren Automaten
- spezifizieren und implmentieren autonome Systeme

Methodenkompetenz
Die Studierenden

- synthesisieren Rechnerarchitekturen
- können Methoden des Hardwareentwurfs auf verschiedene Systeme transferieren

Sozialkompetenz
Die Studierenden

- diskutieren qualifiziert über Hardware

Selbstkompetenz
Die Studierenden

- sind dazu in der Lage, ihren Kenntnisstand klar gegen Fachkräfte verwandter Disziplinen abzugrenzen

Module contents
Dieses Modul ist der praktische Teil der Veranstaltung Einführung in die Technische Informatik

Literaturempfehlungen
Skript zur Veranstaltung, Patterson, D.A., Hennesy, J.L.:Computer Organisation and Design: The Hardware/Software Interface

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
Jedes Sommersemester

Module capacity
unlimited

Modulelevel / module level
AC (Aufbaucurriculum / Composition)

Modulart / typ of module
Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method
P

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
Am Ende der Vorlesungszeit
PK

Form of teaching
Practical training

SWS
4

Frequency
SoSe

Workload Präsenzzeit
56 h
inf203 - Embedded Systems I

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

Verwendbarkeit des Moduls:
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Verwendbarkeit des Moduls:
Nebel, Wolfgang (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)
Fränzle, Martin Georg (Prüfungsberechtigt)

Zuständige Personen:

Prerequisites:
Skills to be acquired in this module:
This module provides an introduction to the design of digital embedded systems.

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 State Charts) 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.

Literatureempfehlungen:
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 elt ZA 1536)
inf204 - Embedded Systems II

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Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
- Nebel, Wolfgang (Prüfungsberechtigt)
- Fränzle, Martin Georg (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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.

**Literaturempfehlungen**

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".
- **Modul level**: AS (Akzentsetzung / Accentuation)
- **Module type**: je nach Studiengang Pflicht oder Wahlpflicht
- **Teaching/Learning method**: V+Ü
- **Previous knowledge**
- **Final exam of module**: At the end of the lecture times
- **Type of examination**: Written or oral Exam
- **Form of teaching**: Comment
- **SWS**: Frequency
- **Workload of compulsory attendance**: 56 h

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inf205 - Formal Methods in Embedded System Design

Module label: Formal Methods in Embedded System Design

Modulkürzel: inf205

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen:
- Fränzle, Martin Georg (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:
Embedded computer systems sustain a permanent interaction with their environment. This interaction may lead to hardly predictable stimuli and response 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:

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
**Literaturempfehlungen**


**Links**

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**Vorkenntnisse / Previous knowledge**


**Examination**

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<td>Exercises</td>
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**Präsenzzeit Modul insgesamt**

56 h
inf207 - Electrical Engineering

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Verwendbarkeit des Moduls

- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen

Hein, Andreas (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

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

Literaturempfehlungen

<table>
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<th>essential:</th>
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<td>slides</td>
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inf208 - Microrobotics and Microsystems Technology

Module label: Microrobotics and Microsystems Technology
Modulkürzel: inf208
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen:
- Fatikow, Sergej (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
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; micromechanical 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

Literaturempfehlungen:
Essential:
Lecture notes

Recommended:


Secondary Literature (only available for some subareas):

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

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inf209 - Control Theory

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

Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen
- Fatikow, Sergej (Prüfungsberechtigt)
- Hein, Andreas (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
- 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 modelling 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 modelling; 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; computer-based control MATLAB/Simulink

Literaturempfehlungen
- Unbehauen, H.:Regelungstechnik I, Klassische Verfahren zur Analyse und Synthese linearer kontinuierlicher Regelsysteme
- Lütz, H. und Wendt, W.:Taschenbuch der Regelungstechnik
- further reading will be announced at lecture

Links

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| **Vorkenntnisse / Previous knowledge** | - Differenzialgleichungen  
- Analysis II  
- Grundlagen der Elektrotechnik |

**Examination**

| **Final exam of module** | At the end of the lecture period | Hands-on exercises and written or oral exam |

**Form of teaching**

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**Präsenzzeit Modul insgesamt** 56 h
inf210 - Signal and Image Processing

Module label | Signal and Image Processing
Modulkürzel | inf210
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen
Fränzle, Martin Georg (Prüfungsberechtigt)
Hein, Andreas (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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

Literaturempfehlungen
essential:
Slides
recommended:
-Meyer, M.; Signalverarbeitung: Analoge und digitale Signale, Systeme und Filter
-Grüningen, D. C. v.; Digitale Signalverarbeitung: mit einer Einführung in die kontinuierlichen Signale und Systeme
-Tönnies, K.; Grundlagen der Bildverarbeitung; Pearson Studium 2005
-Lehmann, Th.; Oberschelp, W.; Pelinak, E.; Pepges, R.; Bildverarbeitung in der Medizin; Springer Verlag 1997
-Handels, H.; Medizinische Bildverarbeitung; Teubner Verlag, Stuttgart - Leipzig 2000

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| Previous knowledge                         | Modul math040 Analysis II b: Differentialrechnung mehrerer Variablen |
| Examination                                 | Prüfungszeiten                      |
| Final exam of module                       | Type of examination                 |

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| Präsentzeit Modul insgesamt                | 56 h                              |
**inf402 - Graph Transformation Systems**

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlpbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

**Zuständige Personen**
- Habel, Annegret (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

<table>
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<th>Modelling of systems, introduction to graph transformation systems, sequential and parallel independence, termination and confluence.</th>
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<tr>
<td><strong>Professional competence</strong></td>
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<tr>
<td></td>
<td>• Know the basics of graph transformation systems and graph programs</td>
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<tr>
<td></td>
<td>• Describe graph transformation systems and graph programs</td>
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<td></td>
<td>• Define the Turing completeness of graph programs</td>
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<tr>
<td></td>
<td>• Model systems and system changes</td>
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<td></td>
<td>• Prove sequential and parallel independence of derivations</td>
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<tr>
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<td>• Prove termination and confluence of graph transformation systems</td>
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<td><strong>Methodological competence</strong></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• Recognize graph transformation systems as a versatile tool for modelling in computer science</td>
</tr>
<tr>
<td><strong>Social competence</strong></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• Work together in small groups to solve problems</td>
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<tr>
<td></td>
<td>• Present solutions to problems to groups of other students</td>
</tr>
<tr>
<td><strong>Self-competence</strong></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• Learn persistence in pursuing difficult tasks</td>
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<td>• Learn precision in writing down solutions</td>
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**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.

**Literaturempfehlungen**


**Links**

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<td>Präsenzzeit Modul insgesamt</td>
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</table>
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

**Literaturempfehlungen**

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| Vorkenntnisse / Previous knowledge | Grundveranstaltungen Mathematik und Informatik |

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| Präsenzzeit Modul insgesamt | 56 h |

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inf404 - Petri Nets

Module label: Petri Nets
Modulkürzel: inf404
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Best, Eike (Prüfungsbeauftragter)
Lehrende, Die im Modul (Prüfungsbeauftragter)

Prerequisites
Skills to be acquired in this module
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.

Professional competence
The students:
- define basic concepts of Petri nets
- classify Petri nets according to their salient properties
- analyse and synthesise Petri nets
- apply Petri nets in the context of well-defined problems

Methodological competence
The students:
- can apply specification and analysis methods based on Petri nets

Social competence
The students:
- present solutions to given problems to a wider audience

Module contents
- Basic concepts of Petri net theory.
- Petri net languages.
- Reachability and coverability.
- Marking equation.
- Linear-algebraic and graph-theoretic structure of Petri nets.
- Free-choice nets.
- Program verification using traps.
- Computing functions with nets.
- Unfoldings.
- High-level nets.

Literaturempfehlungen

Links
Languages of instruction: German, English
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**Präsenzzeit Modul insgesamt** 56 h
inf405 - Algorithmic Graph Theory

Module label: Algorithmic Graph Theory
Modulkürzel: inf405
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen:
- Wilkeit, Elke (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

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
G) Approximation Algorithms

Literaturempfehlungen:
A detailed bibliography is contained in the lecture notes of this module.
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| Präsenzzeit Modul insgesamt | 56 h |
inf407 - Program Verification

Module label: Program Verification
Modulkürzel: inf407
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen:
Olderog, Ernst-Rüdiger (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

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

Skills to be acquired in this module:

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.

Literaturempfehlungen

essential:

Or the extended English version:
**Language of instruction**: German  
**Duration (semesters)**: 1 Semester  
**Module frequency**: unregelmäßig  
**Module capacity**: unlimited  
**Module level**: AS (Akzentsetzung / Accentuation)  
**Module type**: je nach Studiengang Pflicht oder Wahlpflicht  
**Teaching/Learning method**: V+Ü  
**Previous knowledge**: Theoretische Informatik I und II  
**Final exam of module**: At the end of the lecture period  
**Type of examination**: Written exam or oral exam  

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**Präsenzzeit Modul insgesamt**: 56 h
inf408 - Algorithms for Software Verification

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Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Olderog, Ernst-Rüdiger (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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)

Literaturempfehlungen
- E.M. Clarke, O. Grumberg, S. Jha, Y. Lu, and H. Veith, Counterexample-guided abstraction refinement
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# inf409 - Formal Languages

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## Prerequisites

**Skills to be acquired in this module**

**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)).

## Literaturempfehlungen


## Links

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

im 2-Jahres-Zyklus

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)
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| Präsenzzeit Modul insgesamt | 56 h |

|  |  |  |  |  |
inf521 - Medical Informatics

Module label: Medical Informatics

Modulkürzel: inf521

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls

- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen

Hein, Andreas (Module responsibility)

Klausen, Andreas (Module responsibility)

Kaspar, Mathias (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

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 safety (Regulatory Affairs)
- Telemedicine / Customer Health informatics
- Medical technology introduction, biomedical technology
- Biosignal processing, sensor technology
- Robotics, prosthetics

Literaturempfehlungen
- 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
- Carl Hanser Verlag München 2009

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| Präsenzzzeit Modul insgesamt               | 56 h   |
## inf530 - Artificial Intelligence

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### Verwendbarkeit des Moduls
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Mastermodule

### Zuständige Personen
- Sauer, Jürgen (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

### Prerequisites

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

### Literatureempfehlungen

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**Präsenzzeit Modul insgesamt**

56 h
inf600 - Business Informatics I

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

Verwendbarkeit des Moduls

- Bachelor’s Programme Business Informatics (Bachelor) > Basiscurriculum
- Bachelor’s Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Bachelor’s Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Bachelor’s Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Mastermodule

Zuständige Personen

Hahn, Axel (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

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 focuses 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.

**Literatureempfehlungen**

- 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 / module level**: AS (Akzentsetzung / Accentuation)
- **Modulart / typ of module**: je nach Studiengang Pflicht oder Wahlpflicht
- **Lehr-/Lernform / Teaching/Learning method**: V+Ü

**Vorkenntnisse / Previous knowledge**

- **Examination**: Prüfungszeiten
- **Final exam of module**: At the end of the lecture period
- **Tasks and active partaking during the exercises / written exam or oral exam**

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**Präsenzzeit Modul insgesamt**: 56 h
inf601 - Business Informatics II

Module label: Business Informatics II

Modulkürzel: inf601

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum - Pflichtbereich
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen:
Marx Gomez, Jorge (Prüfungsberechtigt)

Lehrenden, Die im Modul (Prüfungsberechtigt):

Prerequisites

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 Ressource 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 signifiance 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 aquired 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 propdition 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

Literatureempfehlungen

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

Links

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

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

jährlich

Module capacity

unlimited

Modullevel / module level

AS (Akzentsetzung / Accentuation)

Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method

V+Ü

Vorkenntnisse / Previous knowledge

Examination

Prüfungszeiten

Type of examination

Final exam of module

Usually two weeks after lecture time

Written exam max. 120 minutes

Form of teaching

Comment

SWS

Frequency

Workload of compulsory attendance

Lecture

2

SoSe

28

Exercises

2

SoSe

28

Präsenzzeit Modul insgesamt

56 h
inf603 - Planning and Simulation in Logistics

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**Verwendbarkeit des Moduls**

- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

**Zuständige Personen**

Sauer, Jürgen (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

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.

**Learning objectives:**
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.

**They are able:**

- to identify, classify and associate solutions to problems/challenges
- to model and implement a production plan with the simulation tool

**Professional competence**

The students:

- Characterise basic problems/challenges of the production planning and logistic simulation
- Name approaches/concepts and algorithms to solve simulation and planning problems/challenges
- Identify, classify and assign solutions to planning problems/challenges
- Model and implement a given production process with a simulation tool

**Methodological competence**

The students:

- Model small production problems with a simulation tool and solve given tasks with the tool

**Social competence**

The students:

- Develop solutions to given simulation problems in small groups
- Present the solutions to other groups

**Self-competence**

The students:

- Reflect their own solutions in conjunction with other solutions

**Module contents**

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.

**Literaturempfehlungen**

- selected material on the simulation tool
- others will be announced in the lecture

**Links**
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<th><strong>Workload of compulsory attendance</strong></th>
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| **Präsenzzeit Modul insgesamt** | 56 h |
# inf608 - eBusiness

<table>
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<td>Workload</td>
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<td>Verwendbarkeit des Moduls</td>
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<tr>
<td></td>
<td>- Bachelor's Programme Business Informatics (Bachelor) &gt; Aufbaucurriculum - Pflichtbereich</td>
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<tr>
<td></td>
<td>- Bachelor's Programme Computing Science (Bachelor) &gt; Akzentsetzungsbereich - Wahlbereich Informatik</td>
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<td>- Bachelor's Programme Economics and Business Administration (Bachelor) &gt; Studienrichtung Wirtschaftsinformatik</td>
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<td></td>
<td>- Master of Education Programme (Gymnasium) Computing Science (Master of Education) &gt; Mastermodule</td>
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<td></td>
<td>- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) &gt; Mastermodule</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>Marx Gomez, Jorge (Prüfungsberechtigt)</td>
</tr>
<tr>
<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td>The module provides an introduction to the &quot;Electronic Business&quot; (e-business). The graduates know the fundamental and current technologies, advanced concepts, applications and competitive strategies of the &quot;Electronic-Commerce&quot; (e-commerce). The knowledge and abilities acquired in this module are directly applicable in study and business. They are deepening the basics from the module „Wirtschaftsinformatik II“. They provide a professional e-business consulting background and the skills to design software products for this area of business in practice.</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td></td>
</tr>
<tr>
<td>Professional competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>- Name and discuss the eBusiness key challenges</td>
</tr>
<tr>
<td></td>
<td>- Discuss the chances of the added value and the changes of commercial models by the internet</td>
</tr>
<tr>
<td></td>
<td>- Define the concepts of e-business and e-commerce.</td>
</tr>
<tr>
<td></td>
<td>- Discuss the change of retail trade and the transactions between companies in e-business</td>
</tr>
<tr>
<td></td>
<td>- Name current payment systems and communication technologies</td>
</tr>
<tr>
<td></td>
<td>- Discuss the possibilities of the internet in order to simplify the administration and the coordination of internal and external business processes</td>
</tr>
<tr>
<td></td>
<td>- Characterise the challenges for the management caused by e-business and e-commerce</td>
</tr>
<tr>
<td></td>
<td>- Differentiate the concepts and conceptualites of e-business</td>
</tr>
<tr>
<td></td>
<td>- Assess applications with regard to economic points of view</td>
</tr>
<tr>
<td></td>
<td>- Practically learn how to handle core technologies of e-business</td>
</tr>
<tr>
<td>Methodological competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>- Assess the core technologies of e-business and e-commerce</td>
</tr>
<tr>
<td></td>
<td>- Apply methods in case studies</td>
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<tr>
<td>Social competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>- Develop case studies on basis of given problems in groups</td>
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<tr>
<td></td>
<td>- Present their solutions</td>
</tr>
<tr>
<td>Self-competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>- Learn about their own limitations while planning and developing e-commerce applications</td>
</tr>
<tr>
<td>Module contents</td>
<td>The module provides the following contents:</td>
</tr>
<tr>
<td></td>
<td>- The definition of the core e-business concepts and the technical conditions for the implementation</td>
</tr>
<tr>
<td></td>
<td>- Introduction of the variations of e-commerce, especially the Business-to-Consumer (B2C) and Business-to-Business (B2B) concepts and the current research in this field</td>
</tr>
<tr>
<td></td>
<td>- Discussion on the economic aspects of e-business based on the theory of informational added value</td>
</tr>
<tr>
<td></td>
<td>- Technological basics of the web and current development technologies for e-commerce web</td>
</tr>
</tbody>
</table>
applications and security mechanisms with focus on online-shops and applications (hands-on exercise topics: HTTP, JSP and SQL Injection, PHP, XML, XML-Security, data modelling, Online-Shop development and Online-Shop administration)

Literaturempfehlungen


Links

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

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

jährlich

Module capacity

unlimited

Modullevel / module level

AS (Akzentsetzung / Accentuation)

Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method

V+Ü

Vorkenntnisse / Previous knowledge


<table>
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<th>Examination</th>
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<td>At the end of the lecture period</td>
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Präsenzzeit Modul insgesamt 56 h
inf701 - Computer Science Education II

Module label: Computer Science Education II
Modulkürzel: inf701
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
- Diethelm, Ira (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
- Professional competence
  The students:
  - (re-)construct the knowledge of computer science by the method of didactical reduction
  - differentiate the development of computer science and evaluate this development with current trends for class
  - select computer science education approaches for lesson planning, organisation and implementation

- Methodological competence
  The students:
  - (re-)construct core concepts of lesson planning for computer science education requirements

- Social competence
  The students:
  - present self-developed lesson plans and lesson materials
  - discuss lesson plans regarding computer science education concepts
  - accept opinions and criticism
  - provide constructive feedback

- Self-competence
  The students:
  - adapt computer science education concepts for lesson planning
  - reflect on their self-perception with regard to the conception of computer science education

Module contents
The lecture will focus on the requirements and challenges of computer science education in grammar school (German: Gymnasium). Main focus:

- Didactical (re-)construction of computer science knowledge, especially its didactical reduction
- Didactical categorisation of computer science and the development, importance and evaluation of computer science in school
- Scheduling, organisation and implementation of computer science in class

Literaturempfehlungen
- Further literature will be announced in the lecture.

Links
http://elearning.uni-oldenburg.de

Language of instruction
- German

Duration (semesters)
- 1 Semester

Module frequency
- jährlich
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**Vorkenntnisse / Previous knowledge**

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inf703 - Computer Science Education III

Module label
Computer Science Education III

Modulkürzel
inf703

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Diethelm, Ira (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
The students:

- know research methods from the computer science education field and apply these methods exemplary
- are able to verify computer science education approaches and develop those approaches
- characterise computer science education approaches by their effects to the lesson content, methods and tools

Professional competence
The students:

- characterise computer science education research methods
- analyse research issues with computer science education research methods
- differentiate computer science education concepts and their effects on lesson content, teaching methods and tools

Methodological competence
The students:

- transfer the research methods acquired on different research issues and adjust them appropriately
- develop research theories, hypotheses and prove them on new contexts

Social competence
The students:

- discuss research methods acquired from other students and lecturers
- present research methods and accept or provide appropriate criticism

Self-competence**
The students:

- include the presented research methods into their plans and activities to prove their hypotheses
- reflect their self-perception with regard to the research methods of computer science education

Module contents

- Computer science education research methods
- The purpose of theoretically developed specific lessons
- Approaches for the evaluation of computer science education or computer science education concepts

Literaturempfehlungen

- Further literature will be announced in the lecture

Links

Language of instruction
German

Duration (semesters)
1 Semester
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<p>| Präsenzzeit Modul insgesamt | 56 h |</p>
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**Verwendbarkeit des Moduls**

- Bachelor's Programme Biology (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Business Administration and Law (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Business Informatics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Bachelor's Programme Chemistry (Bachelor) > Säule "Überfachliche Professionalisierung" more...
- Bachelor's Programme Comparative and European Law (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Computing Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Economics and Business Administration (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Bachelor's Programme Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Engineering Physics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Environmental Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Physics (Bachelor) > Wahlbereich Physik, Geowissenschaften und Informationswissenschaften
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Social Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Sustainability Economics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Biology (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme General Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme History (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Music (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Physics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
Professionalisierung

- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Technology (Bachelor) > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > Säule "Überfachliche Professionalisierung"
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Recht und Gesellschaft

### Zuständige Personen

| Wilkeit, Elke (Prüfungsberechtigt) |
| Lehrenden, Die im Modul (Prüfungsberechtigt) |

### Prerequisites

#### Skills to be acquired in this module

Graduates of the module Informatik und Gesellschaft know the history of the development of Information technology and its impact on society and are familiar with issues of data protection.

They will be able, individually or in a team, to analyze the ethical and socio-political implications of different areas and applications of computer science and develop a reasoned own position on this, in particular concerning their professional responsibilities as computer scientists.

They have learned to present the results of their work convincingly and suitable for their target group using appropriate media and they are able to organize events such as workshops or small conferences for that purpose.

**Professional competence**

The students:

- reflect on the ethical and societal aspects of selected areas of computer science
- create and design websites
- create and manage documents in a team

**Methodological competence**

The students:

- explore methods of structured teamwork
- organize project work
- make presentations with different media

**Social competence**

The students:

- develop a subject area as a team
- teach a bigger audience to appreciate their knowledge
- discuss their observations and opinions with others

**Self-competence**

The students:

- reflect their role in a team
- reflect their role as computer scientists in society

### Module contents

In brief, topics like the following are covered:

- Computer Crime
- Computer Games
- Data Protection
- Electronic Democracy
- Ethics in Computer Science
- History of Information Technology
- Use of information technology at school
- Internet - integration or division of society?
- Artificial Intelligence
- Manipulation by War Games
- Open Source Software
- Robots in Society
- Trustworthy Systems

**Literatureempfehlungen**

- See reference books Informatik und Gesellschaft in BIS.
- H. Klaeren u.a., (Eds.), 1999: Tübinger Studientexte Informatik und Gesellschaft. Universität Tübingen.

**Links**

<table>
<thead>
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<th>Language of instruction</th>
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**Vorkenntnisse / Previous knowledge**

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<th>Prüfungszeiten</th>
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<tbody>
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<td>During semester and at the end</td>
<td>Portfolio (5-6 partial performances)</td>
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<td>Practical training</td>
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**Präsenzzeit Modul insgesamt**

56 h
## wir806 - Information Technology Law

<table>
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### Verwendbarkeit des Moduls
- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Recht und Gesellschaft
- Master's Programme Business Administration, Economics and Law (Master) > Mantelmodule
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "Recht der Wirtschaft" (RdW)
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik

### Zuständige Personen
- Lehrenden, Die im Modul (Prüfungsberechtigt)
  - Louven, Sebastian (Module counselling)
  - Taeger, Jürgen (Module responsibility)

### Prerequisites
Skills to be acquired in this module
- Upon completion of the module, students will be able to:
  - deal with all legal questions arising from the use of information and communication technology in all sectors of society,
  - identify legal issues arising from the use of information and communication technology,
  - draft solutions for these legal questions.

### Module contents
- Internet law; IT contracts law

### Literaturempfehlungen
- Köhler, Fetzer, Recht des Internet, 8. Aufl., 2016
- Redeker, IT-Recht, 6. Aufl., 2017

### Links
- 

### Language of instruction
- German

### Duration (semesters)
- 1 Semester

### Module frequency
- jährlich

### Module capacity
- unlimited

### Modulelevel / module level
- ---

### Modulart / typ of module
- je nach Studiengang Pflicht oder Wahlpflicht

### Lehr-/Lernform / Teaching/Learning method
- 

### Vorkenntnisse / Previous knowledge
- 

### Examination
- Prüfungszeiten
- Type of examination
- Final exam of module during term presentation and handout, written exam or oral exam

### Form of teaching

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### Präsenzzeit Modul insgesamt
- 56 h
inf401 - Foundations of Theoretical Computer Science

Module label
Foundations of Theoretical Computer Science

Modulkürzel
inf401

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule
- Bachelor's Programme Mathematics (Bachelor) > Nebenfachmodule
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule (60 KP)
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Habel, Annegret (Module responsibility)
Olderog, Ernst-Rüdiger (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
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.

Literaturempfehlungen
- essentiell: Skript "Grundbegriffe der Theoretischen Informatik", jeweils in aktueller Ausgabe
Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | jährlich
Module capacity | unlimited
Module level / module level | AC (Aufbaucurriculum / Composition)
Module art / typ of module | je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method | V+Ü

Vorkenntnisse / Previous knowledge

Examination | Prüfungszeiten | Type of examination
Final exam of module | At the end of the lecture period | Written or oral exam

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Präsenzzeit Modul insgesamt | 56 h
inf704 - Computer Science Education III

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Zuständige Personen

Prerequisites

Skills to be acquired in this module

Module contents

Literaturempfehlungen

Links

Language of instruction | German

Duration (semesters) | 1 Semester

Module frequency

Module capacity | unlimited

Modullevel / module level | MM (Mastermodul / Master module)

Modulart / typ of module | Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination | Prüfungszeiten | Type of examination

Final exam of module | Portfolio

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Präsenzzeit Modul insgesamt | 56 h
inf008 - Information Systems II

Module label: Information Systems II

Modulkürzel: inf008

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Master Applied Economics and Data Science (Master) > Specialization
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik

Zuständige Personen:
Grawunder, Marco (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

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

Literaturempfehlungen:
Suggested reading:

- Härder, T., Rahm, E.: Datenbanksysteme - Konzepte und Techniken der Implementierung, Morgan Kaufmann
- U. Leiser, F. Naumann. Informationsintegration: Architekturen und Methoden zur Integration verteilter und heterogener Datenquellen. dpunkt
- Bauer/Günzel. Data-Warehouse-Systeme, dpunkt
- Han/Kamber/Pel. Data Mining: Concepts and Techniques, Morgan Kaufmann
### Links

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<td>Wahlmodul / Opportunity</td>
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<td>V+Ü</td>
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### Vorkenntnisse / Previous knowledge

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### Form of teaching

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**Präsenzzeit Modul insgesamt** 56 h
## inf009 - Database Practical

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik
- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Praktische Vertiefung (60 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodul
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Praktische Vertiefung der Informatik

**Zuständige Personen**
- Grawunder, Marco (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
- 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.

**Professional competence**
The students:
- Realise, implement and program data base systems
- Program and implement database-oriented system routines
- Implement optimisation goals in the modelling phase
- Administer professional database systems (installation, maintenance and adjustment)
- Recognise database systems' performance problems and are able to fix them with according methods
- Organise and control processes of database systems

**Social competence**
The students:
- Solve database system problems in a team

**Self-competence**
The students:
- Acknowledge the limits of their ability to cope with pressure during the implementation and are aware of failures
- Reflect their self-perception

**Module contents**
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.

Contents of this module are:
- System-oriented database management programming,
- Implementation of catalogue systems,
- Optimisation strategies based on parallelisation and partitioning requirements

**Literaturempfehlungen**
Held Andrea (2005). Oracle 10g Hochverfügbarkeit Addison-Wesley.

**Links**
http://www-is.informatik.uni-oldenburg.de/227/

**Language of instruction**
German
<table>
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| **Vorkenntnisse / Previous knowledge** | Informationssysteme I  
Betriebssystemkenntnisse |
| **Examination**          | Prüfungszeiten  
Type of examination |
| **Final exam of module** | At the end of the lecture period  
Oral exam |
| **Form of teaching**     | Practical training |
| **SWS**                  | 4           |
| **Frequency**            | WiSe       |
| **Workload Präsenzzeit** | 56 h       |
inf201 - Computer Engineering II

Module label: Computer Engineering II
Modulkürzel: inf201
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls
- Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP)
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen
Nebel, Wolfgang (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
The module qualifies students to analyse computer architectures, understand computer components, design and optimize computers and components, and to discuss domain-specific hardware design.

Professional competence
The students:
- describe computer components
- design and optimise computer components
- understand manufacturing processes for VLSI circuits

Methodological competence
The students:
- analyse computer architectures

Social competence
The students:
- discuss computer hardware and manufacturing processes competently
- are able to transfer their knowledge of hardware design to other domains different from computer science

Self-competence
The students:
- are able to assess their own competences in relation to qualified personnel from related domains

Module contents
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.

Literatureempfehlungen
- Lecture notes
- Oberschelp, W., Vossen, G.: Rechneraufbau und Rechnerstrukturen; Oldenbourg Verlag

Additional literature will be mentioned in the lectures

Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
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### Vorkenntnisse / Previous knowledge

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### Form of teaching

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<td>WSe</td>
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### Präsenzzeit Module insgesamt

| 56 h |
inf410 - Model-Checking

Module label: Model-Checking
Module kurz: inf410
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Mastermodule

Zuständige Personen

Prerequisites
Skills to be acquired in this module
Module contents
Literaturempfehlungen
Links

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

Module frequency
Module capacity: unlimited
Modullevel / module level: MM (Mastermodul / Master module)
Modulart / typ of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
Klausur oder mündliche Prüfung

Form of teaching
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2
Sose oder WiSe
28
Exercises
2
Sose oder WiSe
28

Präsenzzeit Modul insgesamt
56 h
# Abschlussmodul

**mam - Master Thesis and Colloquium**

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**Verwendbarkeit des Moduls**

- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Abschlussmodul

**Zuständige Personen**

- Diethelm, Ira (Module responsibility)
- der Informatik, Lehrende (Module counselling)
- Lehrenden, Die im Modul (Module counselling)

**Prerequisites**

- unlimited

**Skills to be acquired in this module**

- The students prove that they are able to process and solve complex computer science tasks based on gained scientific knowledge and applied research methods. The students successfully implement a task especially by using their acquired professional and methodological knowledge and their professional and social competences.
- The accompanying seminar is used to discuss the master’s thesis methodically and content-related.
- During the seminar the exchange of research and practical experience fosters the students’ ability to discuss and evaluate their thesis with other students and experts.
- The master’s thesis is finished by a colloquium.

**Professional competence**

- The students:
  - Recognise and evaluate applied techniques and methods of their subject and are aware of their limits
  - Design solutions for complex, possibly vaguely defined or unusual computer science tasks/problems and evaluate these with reference to state of the art computer science and technology
  - Identify, structure and solve problems/tasks, also in new or developing subject areas
  - Apply state of the art and innovative methods to solve problems, if necessary from other disciplines
  - Relate knowledge from different disciplines and apply this new knowledge in complex situations
  - Develop complex computer systems, processes and datamodels
  - Are aware of the current limits and contribute to the development of computer science research and technology
  - Discuss and evaluate recent computer science developments

**Methodological competence**

- The students:
  - Identify and develop one or more solutions
  - Evaluate and apply tools, technology and methods sophisticatedly
  - Examine tasks with technical and research literature, write an academic article and present their solutions academically
  - Schedule processes and resources
  - Apply project management techniques
  - Combine new and original approaches and methods creatively
  - Evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research

**Social competence**

- The students:
  - Communicate with users and experts convincingly
  - Take reasonable decisions

**Self-competence**

- The students:
  - Pursue the overall and special computer science development critically
  - Implement innovative professional activities effectively and independently
  - Recognise their abilities and extend them purposefully
  - Reflect their self-perception and actions with regard to professional, methodological and social aspects
  - Develop and reflect self-developed hypothesis to theories independently
The content of this module is an independent topic research. The research findings will be presented and discussed in a master's thesis colloquium.

<table>
<thead>
<tr>
<th>Module contents</th>
<th>The content of this module is an independent topic research. The research findings will be presented and discussed in a master's thesis colloquium.</th>
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<tr>
<td>Literatureempfehlungen</td>
<td>Wird entsprechend des konkreten Themas spezifiziert</td>
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