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Modules for Computing Science

Kernmodule

inf900 - Group Project

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<td>Credit points</td>
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<td>Workload</td>
<td>720 h</td>
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Verwendbarkeit des Moduls

- Master's Programme Business Informatics (Master) > Kernmodule
- Master's Programme Computing Science (Master) > Kernmodule
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

- The students get familiar with different software development aspects in a team. Apart from software engineering knowledge and skills they develop key competences like project management, teamwork, problem solving competence and conflict management.
- Additionally, students develop special knowledge, skills and competences from the project group topic.

Professional competence

The students:

- characterise and apply computer science basics (algorithms, data structures, programming, basics of practical, technical and theoretical computer science)
- define and describe essential mathematical, logical and physical basics of computer science
- define and illustrate the core disciplines of computer science (theoretical, practical and technical computer science)

Methodological competence

The students:

- examine problems, use formal methods to phrase and analyze them appropriately
- evaluate problems by the use of technical and scientific literature
- reflect on a scientific topic and write a scientific seminar paper under guidance and present their findings

Social competence

The students:

- integrate criticism into their own actions
- respect team decisions
- communicate with users and experts convincingly

Self-competence

The students:

- take on project management tasks
- 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 hypotheses to theories independently
- work in their field independently

Module contents

Cooperative development of a large-scale computer science project. This project general includes the (further) development of a hard or software system.

Literaturempfehlungen

According to the assigned task

Links

https://www.uni-oldenburg.de/informatik/studium-lehre/infos-zum-studium/projektgruppen-im-masterstudium/

Languages of Instruction

German, English

Duration (semesters)

2 Semester

Module frequency

semi-anual
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<td>AS (Akzentsetzung / Accentuation)</td>
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<td>Pflicht o. Wahlpflicht / compulsory or optional</td>
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| **Vorkenntnisse / Previous knowledge** | - Programmierkurs  
- Softwaretechnik  
- Soft Skills |
| **Examination** | **Prüfungszeiten** | **Type of examination** |
| **Final exam of module** | Im Stud.IP nach Bekanntgabe der einzelnen Gruppen und Themen | Active involvement, presentation, final report, project assessment |
| **Form of instruction** | Project group |
| **SWS** | 8 |
| **Frequency** | SoSe und WiSe |
| **Workload Präsenzzeit** | 112 h |
### Module label
Study Abroad I

### Modulkürzel
inf862

### Credit points
6.0 KP

### Workload
180 h

### Verwendbarkeit des Moduls
- Master's Programme Business Informatics (Master) > Kernmodule
- Master's Programme Computing Science (Master) > Kernmodule

### Zuständige Personen

### Prerequisites

### Skills to be acquired in this module

### Module contents

### Literaturempfehlungen

### Links

### Language of instruction
German

### Duration (semesters)
Semester

### Module frequency
unlimited

### Module level / module level

### Modulart / typ of module

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

### Vorkenntnisse / Previous knowledge

### Examination

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### Form of instruction
VA-Auswahl

### SWS

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#### Zuständige Personen

#### Prerequisites

Skills to be acquired in this module

#### Module contents

Literaturempfehlungen

Links

#### Language of instruction

German

#### Duration (semesters)

Semester

#### Module frequency

unlimited

#### Modulelevel / module level

#### Modulart / typ of module

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

#### Vorkenntnisse / Previous knowledge

Examination

Prüfungszeiten

Type of examination

Final exam of module

RE

#### Form of instruction

VA-Auswahl

#### SWS

Frequency

--

Workload Präsenzzeit

0 h
Praktische Informatik

inf006 - Software Engineering II

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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) > Wahlpflichtmodule (Praktische Informatik)
- 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 (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
The objective of the module inf006 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

**Literaturempfehlungen**
- 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)
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<td>At the end of the lecture period</td>
<td>Portfolio (30-minute presentation, 1 paper (4 pages, IEEE) and oral exam)</td>
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| Präsenzzzeit Modul insgesamt | 56 h |
inf100 - Human Computer Interaction

Module label: Human Computer Interaction

Modulkürzel: inf100

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction

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

Prerequisites

Skills to be acquired in this module
With the help of suitable resources, the students can design, prototype, and evaluate a human-machine interface following the user-centered design process (HCD).

Professional competence
The students:
- can describe and explain the HCD process.
- can classify an unknown method into the HCD process when they are presented with a brief description.
- can select a suitable prototyping approach for a given application.
- can select a suitable prototyping method for a given application.
- can apply selected prototyping methods to create an interactive system.
- can name basic characteristics of human perception and motor skills and explain their importance for the development of interactive systems.
- can suggest and motivate improvement for a given user interface based on the gestalt laws.
- can explain the characteristics of human visual search and utilize it to improve given interfaces.
- can critically compare several variants of an interactive system’s concept based on the "Multiple Resource Theory".

Methoden competence
The students:
- can critically compare and select methods for context of use and/or user requirements analysis.
- can apply methods for context of use and/or user requirements analysis to a real-world example.
- can retrospectively discuss and evaluate the use of a method for context of use and/or user requirements analysis.
- can plan, moderate and evaluate an ideation session.
- can formulate a precise research question based on a given problem description.
- can discuss the advantages and disadvantages of an experiment design.
- can select a suitable experiment design for a given research question.
- can define hypotheses and null hypotheses for a given experiment.

Social competence
The students:
- can work out solutions for a given design problem in group work.
- can present solutions to design problem in the plenum.
- can motivate their methodical approach to a design problem.
- can discuss their designs and results in an appropriate and professional manner with the plenum.
- can accept criticisms by their peer group as valuable contributions to their designs.

Module contents
The module covers research methods in the field of human-computer interaction. It discusses the core principles of human-computer interaction and the human-centered design process and its phases, context of use, requirements, and task analysis, prototyping and evaluation. Research methods used in the different phases of the process are introduced and discussed.

Available design options for human-machine interfaces are presented and discussed with regard to human perception capabilities and their limitations. The module discusses methods for user research, including surveys, diaries, case studies, interviews, and focus groups, as well as physiological measurements.

The module goes into further detail on evaluation methods, and introduces the foundations of experimental research in human-computer interaction, including types of research, research hypotheses, experimental design, and statistical analysis.

During the practical project, a concrete human-computer interface will be designed, developed and evaluated.
### Literaturempfehlungen
- Markus Dahm, Grundlagen der Mensch Computer-Interaktion. Pearson, 2006
- Literature in the reserve shelf in the university bibliography. Link list in Stud.IP.

### Links
- medien.informatik.uni-oldenburg.de/lehre

### Languages of instruction
- German, English

### Duration (semesters)
- 1 Semester

### Module frequency
- once a year

### Module capacity
- unlimited

### Reference text
- Useful previus knowledge: Interactive Systems

### Modullevel / module level
- AS (Akzentsetzung / Accentuation)

### Modulart / typ of module
- V+P

### Vorkenntnisse / Previous knowledge
- Grundkenntnisse Programmierung

### Examination
- The completed practical projects will be presented on a single project day, which will take place at the end of the lecture period. The oral exam takes place within the last two weeks of the lecture period. If necessary, re-examinations will take place at the end of the term. Details on the schedule can be found on the websites of the department and in Stud.IP.
- Practical group project which progress has to be presented regularly during the tutorials. Oral exam on the topics of the lecture. Practical project and oral exam count 50% each to the final grade. Both practical project and oral exam have to be passed individually.

### Form of instruction

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### Präsenzzeit Modul insgesamt
- 56 h
inf105 - Fault Tolerance in Distributed Systems

Module label | Fault Tolerance in Distributed Systems
Modulkürzel | inf105
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Praktische Informatik

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

Prerequisites

Skills to be acquired in this module
This module provides knowledge of fault-tolerant distributed systems. The terminology, structure, conception, core challenges and related implementation concepts will be covered in detail.

Professional competence
The students:
- Assess what a fault-tolerant distributed system is and develop awareness of its capabilities
- Name and discuss common implementations of fault-tolerant distributed systems

Methodological competence
The students:
- Reflect the implementation challenges of a distributed system
- Are able to adapt and evolve implementation concepts of fault-tolerant distributed systems in new contexts

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 initially applied methods for problem solving
- Question their initial solutions in the light of newly learned methods

Module contents

1. Fault, Error, Failure
2. Failure semantics, Fault tolerance
3. Byzantine agreement protocols
4. Stable storage
5. Fail-stop processors
6. Atomic commit protocols
7. Classification of replication control schemes - pessimistic vs. optimistic - semantic vs. syntactic - static vs. dynamic
8. Consistency notions
9. Quality criteria
10. Survey of replication control schemes
11. Design of replication control schemes
12. Unifying frameworks
13. Replication in practice

Literatureempfehlungen

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| Präsenzzeit Modul insgesamt | 56 h |

20 / 373
### inf108 - Requirements Engineering and Management

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik

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

**Prerequisites**

**Skills to be acquired in this module**

The objective of the module "Requirements Engineering and Management" is to convey the core concepts and technology of the requirements engineering and of the requirements management. In the second half of the semester these methods and techniques will be carried out practically to develop an exemplary requirements definition.

**Professional competence**

The students:

- integrate the process of requirements engineering in the software engineering process
- name the methods and tools of requirements engineering and management
- select methods and tools from requirements engineering and management to solve given problems appropriately
- illustrate the key tasks of the requirements engineering and management
- name the essential concepts to develop and to structure ideas
- discuss the methods of determination requirements and develop validation concepts
- differentiate the software development core activities in greater detail

**Methodological competence**

The students:

- apply the methods of determination, documentation, validation and confirmation of requirements and
- create a comprehensive requirement document in group work

**Social competence**

The students:

- communicate with all stakeholders dealing with software development
- design project visions in groups
- collect requirements in interviews
- design requirements for software systems collaboratively

**Self-competence**

The students:

- reflect their problem-solving behaviour by applying requirements engineering and management capabilities

**Module contents**

The module deals with requirements analysis core concepts as well as methods and techniques of requirements engineering and management. Topics of this module are:

- the necessity of requirements engineering and management
- the requirements engineering process in the software development process
- requirements engineering process (participants, documents, activities)
- understanding the application domains (vision development, system environment documentation, domain model development, use case identification)
- requirements collection (functional and non-functional requirements, requirements collection, requirements documentation, requirements validation, requirements needs)
- requirements management

**Literaturempfehlungen**

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inf109 - Information Systems III

Module label: Information Systems III
Modulkürzel: inf109
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master Applied Economics and Data Science (Master) > Specialization
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodulle der Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik

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

Prerequisites:
Skills to be acquired in this module

- Professional competence
  The students:
  - describe concepts, languages and architectures of database systems
  - discuss state-of-the-art database research topics
  - analyse information processing tasks and implement solutions appropriately

- Methodological competence
  The students:
  - propose concrete processing requirements for special application classes
  - assess the consequences of techniques and approaches
  - perform supervised research in the field of information systems
  - analyse and reflect complex information system requirements
  - realize information demands and accordingly gather aim-oriented information

Module contents:
This module is a continuation of the content of information systems I and of information systems II. It deepens and extends the contents of the preceding modules and focuses mainly on current research questions. A special focus lies on concept of distributed data management.

Literaturempfehlungen:
- Özsu, M. Tamer; Valduriez, Patrick, Principles of distributed database systems
- Rahm/Saake/Sattler: Verteiltes und Paralleles Datenmanagement, Springer
- Paper from SIGMOD, VLDB or ICDE

Links:
http://www.is.informatik.uni-oldenburg.de/lehre/lehre.html

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

Modulelevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Vorkenntnisse / Previous knowledge:
- Informationssysteme I
- Informationssysteme II
- JAVA

Examination:
Type of examination: Final exam of module
At the end of the lecture period
Written exam, oral exam or term paper

Form of instruction:
- Lecture: 2 SWS, WiSe, 28 h
- Exercises: 2 SWS, WiSe, 28 h

Präsenzzeit Modul insgesamt: 56 h
inf111 - Advanced Database Practical

### Module label
Advanced Database Practical

### Modulkürzel
inf111

### Credit points
6.0 KP

### Workload
180 h

### Verwendbarkeit des Moduls
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik

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

### Prerequisites
- Informationssysteme I

### Skills to be acquired in this module
Objective of the module/skills:
The module enhances the previous knowledge of databases and information systems. In the context of a professional database system the students realize, implement, install and optimize the system. Theoretical and mathematical approaches are additional contents. Additionally the course provides the capability both to describe the differences between NoSQL Databases and (Object-)Relational Databases and how to use them.

**Professional competence**
The students:
- name realisation techniques, implementations and programming of database systems
- program and implement database oriented system routines
- administer a professional database system - identify database system performance problems and solve them appropriately

**Methodological competence**
The students:
- make optimisation decisions during the modelling phase
- construct optimisation strategies mathematically

**Social competence**
The students:
- develop appropriate implementations for given problems in a team

**Self-competence**
The students:
- acknowledge the limits of their ability to cope with pressure during the implementation of database specific solutions

### Module contents
Content of the Module:
The module is a practical course. It is a continuation of the modules Information Systems I and Information Systems II. This module especially deals with the technical and theoretical concepts of database systems. Practical database implementation approaches and optimisation concepts are additional content of the module.

In detail the module provides: low-level database management programming, aspects of catalogue systems implementation, optimisation strategies based on different parallelisation and partitioning strategies, query concepts and modification.

### Literatureempfehlungen
Suggested reading:
- Held Andrea (2007), Oracle 10g Addison-Wesley.
- Feuerstein Steven, Pribyl Bill, Dawes Chip (2007). Oracle PL/SQL, 4. Auflage, O'Reillys Taschenbibliothek
- Oracle 10g, Das Programmierhandbuch, Galileo Computing
- Oracle Database 11g, DBA-Handbuch, Oracle Press-Hanser Verlag
- NoSQL (2011) Hanser Verlag

### Links
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- Duration (semesters): 1 Semester
- Module frequency: jährlich
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inf112 - Modern Programming Technologies

Module label: Modern Programming Technologies
Modulkürzel: inf112
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik

Zuständige Personen:
Boles, Dietrich (Module counselling)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
Skills to be acquired in this module:
The objective of the module is to provide the students with modern programming technologies. After the course, the students are able to use these technologies during the development and implementation of complex applications.

Professional competence:
The students:
- name modern programming technologies
- appropriate use modern programming technologies to solve complex problems

Methodological competence:
The students:
- search for solutions to specific problems in the internet independently

Social competence:
The students:
- develop software in teams
- discuss own and someone else's solutions

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

Module contents:
The module enhances the students' programming skills. It focuses on modern programming technologies. Among others, these are .NET-Framework, Java Server Technologies like Java EE or Spring, Android App development or the development of skills for digital voice assistants. The new technologies are presented in the lecture part. In the exercises, the students develop their own larger applications in groups of 2 or 3 students in reference to the lecture content.

Literaturempfehlungen:
List of links in the learning management system

Links:
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Reference text:
Useful previous knowledge: good programming skills

Modullevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: Wahlmodul / Opportunity
Lehr-/Lernform / Teaching/Learning method: VL+Ü
Vorkenntnisse / Previous knowledge: - gute Programmierkenntnisse

Examination:
Prüfungszeiten

Final exam of module:
The presentation of developed solutions takes place weekly during the exercises. Final delivery of the final software application is one week after the end of the lecture period. The oral exam take place in the second or third week after the end of the lecture.

Type of examination: practical exercises and oral exam
Examination | Prüfungszeiten | Type of examination
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Any re-examinations take place at the end of the semester break. The exact timetable can be found in the learning management system.

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| Frequency | WiSe |
| Workload Präsenzzeit | 56 h |
## inf113 - Operating Systems II

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### Skills to be acquired in this module

The aim of the module "Operating Systems 2" is to convey further knowledge and skills regarding the conception, implementation, and evaluation of operating systems.

**Professional competence:**

The Students:

- assess in detail what an operating system is able do
- recognize the problems in the implementation of operating systems
- identify and evaluate implementations of further subproblems and apply them

**Methodological competence:**

The Students:

- transfer implementation concepts to other contexts
- critically question different solutions with regard to their properties

**Social competence:**

The Students:

- solve problems partly in small groups
- present own potential solutions to the exercise group
- discuss their different potential solutions within the exercise group

**Self-competence:**

The Students:

- accept criticism
- reflect their own potential solutions taking into account the methods taught

### Module contents

The module conveys the following contents:

1. additional aspects of file systems
2. Input/output control
3. User representation
4. Advanced synchronization concepts
5. User interfaces
6. Job scheduling
7. Architectures of operating systems
8. Examples of operating systems

### Literatureempfehlungen

- W. Stallings, Operating Systems. Prentice Hall, most recent edition
- Grundlagen moderner Betriebssysteme, dpunkt-verlag

### Links

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inf131 - Advanced Topics in Human Computer Interaction

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction

**Zuständige Personen**
- Boll-Westermann, Susanne (Module responsibility)
- Lehrende, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
- Lehrender, Die im Modul (Prüfungsberechtigt)

**Skills to be acquired in this module**

This course aims to provide a sample of some of the most recent and significant advances in this exciting area. Topics may include: situational awareness, designing for attention, ambient/peripheral interaction, computer support cooperative work and social computing (CSCW), ubiquitous and context-aware computing, haptic and gestural interaction, audio interaction, gaze-based interaction, biometric interfaces, and embedded, physical and tangible computing, mobile and wearable interfaces.

This course is explicitly not focused on the methods used in HCI practice (i.e., user-centered design cycle), but rather focuses on (recent) research.

**Professional competences:**
The students:
- demonstrate a systematic understanding of knowledge and critical awareness of a selection of the recent research advances in the area of HCI on scientific and technological grounds
- develop ability to conceptualize, design, implement, and evaluate user-centered systems and techniques.
- plan and implement exploratory projects directed at envisioning and prototyping novel interactive artifacts

**Methodological competences:**
The students:
- analyze, review and critique research papers
- carry out original research from start to finish
- summarize and present research findings
- work in a team to produce and evaluate prototypes of novel interactive artifact

**Social competences:**
The students:
- work collaboratively in groups to analyze and review research papers
- summarize and present research findings to rest of class
- discuss how HCI concepts and methods can be applied in analysis, design, and evaluation of interactive technologies.
- discuss social and ethical implications of interactive technologies

**Self-competences:**
The students:
- are comfortable tackling original research questions
- show aptitude in conceptualizing and running both qualitative and quantitative HCI experiments
- acquire the ability to summarize, analyze, and critique published (peer-review) research papers

**Module contents**

HCI is a fast-growing field, where scientific research in this area crosses multiple disciplines. The body of theoretical and empirical knowledge that can inform the design of effective systems is rapidly developing, which underscores the importance of current research in the field.

This course aims to provide a sample of some of the most recent and significant advances in this exciting area.
Topics may include: situational awareness, designing for attention, ambient/peripheral interaction, computer support cooperative work and social computing (CSCW), ubiquitous and context-aware computing, haptic and gestural interaction, audio interaction, gaze-based interaction, biometric interfaces, and embedded, physical and tangible computing, mobile and wearable interfaces.

The course will consist of lectures and lab sessions. Lab sessions will cover assignments (writing paper reviews, presentations, and peer assessment). In addition to assignments and a final exam, a small part of the course includes a mini group-based HCI project.

**Literatureempfehlungen**


**Links**
http://www.medien.informatik.uni-oldenburg.de/lehre

**Language of instruction** English

**Duration (semesters)** 1 Semester

**Module frequency** semi-annual

**Module capacity** 24

**Reference text** Useful previous knowledge: Interactive Systems

**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** Interaktive Systeme

**Examination / Prüfungszeiten**
- Type of examination: Final exam of module
  At the end of the lecture period

**Missing the exam**
If you cannot attend the exam with valid reasons (medical reason, examiner evidence (medical certificate, course registration, boarding passes) you are entitled to a second try.
  - If the reason for missing the exam is valid, you will do your first try of the exam for the parts that you missed on the same date as the second chance exam.
  - If the reason is not valid, you will not get any score from that exam. If your overall score passed the course, you will not have a chance to take the exam again.

**Grading:**
Your grade will be calculated as follows:

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<thead>
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<th>Scored Items</th>
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<tr>
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<td>56 h</td>
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inf170 - Special Topics in 'Information Systems' I

Module label | Special Topics in 'Information Systems' I
--- | ---
Modulkürzel | inf170
Credit points | 6.0 KP
Workload | 180 h
Verwendbarkeit des Moduls | Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen | Grawunder, Marco (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents
According to the assigned course

Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | unregelmäßig
Module capacity | unlimited
Modulelevel / module level | AS (Akzentsetzung / Accentuation)
Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method | 2 Veranstalt. aus V, S, Ü, P, PR (4 SWS)

Vorkenntnisse / Previous knowledge

Examination | Prüfungszeiten
Final exam of module | At the end of the lecture period
Form of instruction | VA-Auswahl
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inf171 - Special Topics in 'Information Systems' I

<table>
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<th>Module label</th>
<th>Special Topics in 'Information Systems' I</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>inf171</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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</table>

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Praktische Informatik

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

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**
The students:

- support team process by their abilities

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**
According to the assigned course

**Literaturempfehlungen**
As announced in course

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
2 Veranst. aus V, S, Ü, P, PR (4SWS)

**Vorkenntnisse / Previous knowledge**

<table>
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<th>Prüfungszeiten</th>
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<td>At the end of the lecture period</td>
<td>Portfolio or presentation or oral exam</td>
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**Form of instruction**
VA-Auswahl
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<td>SoSe oder WiSe</td>
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<tr>
<td>Workload Präsenzzeit</td>
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### Module Information

**Module label**: Special Topics in 'Information Systems' I  
**Modulkürzel**: inf172  
**Credit points**: 3.0 KP  
**Workload**: 90 h  
**Verwendbarkeit des Moduls**:  
- Master's Programme Computing Science (Master) > Praktische Informatik  
**Zuständige Personen**:  
- Grawunder, Marco (Module responsibility)  
- der Informatik, Lehrende (Prüfungsberechtigt)

### Prerequisites

**Skills to be acquired in this module**: This module integrates current developments in the field in adequate study courses.

**Professional competences**

- Define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- Recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

- Examine tasks with technical and research literature, write an academic article and present their solutions academically
- Evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- Schedule time processes and resources

**Social competences**

- Communicate with users and experts convincingly

**Self-competences**

- Pursue the overall and special computer science development critically
- Develop and reflect self-developed hypotheses to theories independently

### Module contents

According to the assigned course

### Literature recommendations

As announced in course

### Links

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modullevel / module level: BC (Basiscurriculum / Base curriculum)
- Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
- Lehr-/Lernform / Teaching/Learning method: 1 V oder 1 S

### Vorkenntnisse / Previous knowledge

**Examination Prüfungszeiten**: Type of examination

**Final exam of module**: At the end of the lecture period Presentation or oral exam
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</table>
inf173 - Special Topics in 'Information Systems’ II

Module label
Special Topics in 'Information Systems’ II

Modulkürzel
inf173

Credit points
3.0 KP

Workload
90 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Praktische Informatik

Zuständige Personen
Grawunder, Marco (Module responsibility)
Lehrende, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:
- communicate with users and experts convincingly

Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
According to the assigned course

Literaturempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modulelevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
V oder S

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture period
Presentation or oral exam
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inf174 - Special Topics in 'Media Informatics and Multimedia Systems' II

Module label: Special Topics in 'Media Informatics and Multimedia Systems' II
Modulkürzel: inf174
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Praktische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction

Zuständige Personen:
Boll-Westermann, Susanne (Module responsibility)
Lehrende, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:
The aim of the module is to integrate the latest developments in the field of "Media Informatics and Multimedia Systems" appropriately into a course of study.

**Professional competences**
The students:
- define and contrast special themes in computer science, and reflect on computer science practices in general.
- recognize and evaluate applied techniques and methods and their limits
- identify, structure and solve problems/tasks, in new or developing subject areas
- apply state of the art and innovative methods to solve problems, if necessary from other disciplines
- recognize current limits and contribute to the development of computer science research and technology
- discuss and evaluate recent computer science developments

**Methodological competences**
The students:
- evaluate and apply tools, technology and methods and utilize them appropriately
- combine new and original approaches and methods creatively
- reflect on problems/tasks, including new or developing subject areas in their discipline and apply computer science methods for investigation and resolution

**Social competences**
The students:
- integrate their skills in a team environment.

**Self-competences**
The students:
- pursue the further development of computer science in general and in this particular sub-field critically
- innovatively conduct professional activities effectively and independently

Module contents:
According to the assigned course

Literaturempfehlungen:
As announced in course

Links:
http://www.medien.informatik.uni-oldenburg.de/lehre

Languages of Instruction:
German, English

Duration (semesters):
1 Semester

Module frequency:
irregular

Module capacity:
unlimited

Modullevel / module level:
AC (Aufbaucurriculum / Composition)

Modulart / typ of module:
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:
1V + 1Ü

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination

Final exam of module:
At the end of the lecture period
<table>
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<th>Prüfungszeiten</th>
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**inf175 - Special Topics in 'Media Informatics and Multimedia Systems' II**

<table>
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<td>Master's Programme Engineering of Socio-Technical Systems (Master) &gt; Human-Computer Interaction</td>
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<td>Zuständige Personen</td>
<td>Boll-Westermann, Susanne (Module responsibility)</td>
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**Prerequisites**

**Skills to be acquired in this module**

The aim of the module is to integrate the latest developments in the field of "Media Informatics and Multimedia Systems" appropriately into a course of study.

**Professional competences**
- define and contrast special themes in computer science, and reflect on computer science practices in general.
- recognize and evaluate applied techniques and methods and their limits.
- identify, structure and solve problems/tasks, in new or developing subject areas
- apply state of the art and innovative methods to solve problems, if necessary from other disciplines
- recognize current limits and contribute to the development of computer science research and technology
- discuss and evaluate recent computer science developments

**Methodological competences**
- evaluate and apply tools, technology and methods and utilize them appropriately
- combine new and original approaches and methods creatively
- reflect on problems/tasks, including new or developing subject areas in their discipline and apply computer science methods for investigation and resolution

**Self-competences**
- pursue the further development of computer science in general and in this particular sub-field critically.
- innovatively conduct professional activities effectively and independently.

**Module contents**

According to the assigned course

**Literaturempfehlungen**

According to the assigned course

**Links**

http://www.medien.informatik.uni-oldenburg.de/lehre

**Languages of instruction**

German, English

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modularl / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

1V + 1Ü

**Vorkenntnisse / Previous knowledge**

**Examination**

Prüfungszeiten

Type of examination

**Final exam of module**

At the end of the lecture period


**Form of instruction**

VA-Auswahl
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**inf176 - Special Topics in 'Media Informatics and Multimedia Systems' I**

<table>
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<tr>
<td><strong>Modulkürzel</strong></td>
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<tr>
<td><strong>Credit points</strong></td>
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<td><strong>Workload</strong></td>
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<td><strong>Verwendbarkeit des Moduls</strong></td>
<td>Master's Programme Computing Science (Master) &gt; Praktische Informatik</td>
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**Zuständige Personen**

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

**Skills to be acquired in this module**

The aim of the module is to integrate the latest developments in the field of "Media Informatics and Multimedia Systems" appropriately into a course of study.

- **Professional competences** The students:
  - define, differentiate, and contrast special themes in computer science, and reflect on computer science practices in general.
  - recognize and evaluate applied techniques and methods and their limits
  - identify, structure and solve problems in new or emerging areas of their discipline
  - apply appropriate and innovative methods to the state of the art in the investigation and resolution of problems, possibly with recourse to other disciplines
  - recognize the limitations of existing knowledge and technology practices and contribute to the further scientific and technological development of computer science
  - discuss current developments in computer science and assess their significance

- **Methodological competences** The students:
  - investigate problems based on technical and scientific literature, compose an article according to scientific criteria, and present their results in a scientific lecture
  - reflect on problems in new or emerging areas of their discipline and apply computer science methods for investigation and resolution
  - do scheduling and planning of resources

- **Social competences** The students:
  - critically pursue the further development of computer science in general and this particular sub-field
  - develop and reflect on their own theories and independent hypotheses

**Module contents**

- According to the assigned course

**Literaturempfehlungen**

As announced in course

**Links**

https://uol.de/medieninformatik/lehrveranstaltungen

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

S oder V

**Vorkenntnisse / Previous knowledge**

**Examination**

<table>
<thead>
<tr>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
</tr>
</thead>
</table>

**Form of instruction**

Seminar

**SWS**

2

**Frequency**

WiSe
| Workload Präsenzzeit | 28 h |
The aim of the module is to integrate the latest developments in the field of "Media Information and Multimedia Systems" into a course of study.

**Professional competences** The students:
- define, differentiate, and contrast special themes in computer science, and reflect on computer science practices in general.
- identify, structure, and solve problems in new or emerging areas of their discipline
- apply appropriate and innovative methods to the state of the art in the investigation and resolution of problems, possibly with recourse to other disciplines
- recognize the limitations of existing knowledge and technology practices and contribute to the further scientific and technological development of computer science
- discuss current developments in computer science and assess their significance

**Methodological competences** The students:
- investigate problems based on technical and scientific literature, compose an article according to scientific criteria, and present their results in a scientific lecture
- reflect on problems in new or emerging areas of their discipline and apply computer science methods for investigation and resolution
- do scheduling and planning of resources

**Social competences** The students:
- communicate effectively verbally and in writing with users and experts

**Self-competences** The students:
- critically pursue the further development of computer science in general and this particular sub-field
- develop and reflect on their own theories and independent hypotheses

According to the assigned course

As announced in course

https://uol.de/medieninformatik/lehrveranstaltungen

German

1 Semester

unregelmäßig

unlimited

AS (Akzentsetzung / Accentuation)

je nach Studiengang Pflicht oder Wahlpflicht

S oder V

At the end of the lecture period

Presentation or oral exam.

<table>
<thead>
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<th>Form of instruction</th>
<th>Course or seminar</th>
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<tr>
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<td>SoSe oder WiSe</td>
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inf178 - Special Topics in 'Software Engineering' I

Module label: Special Topics in 'Software Engineering' I
Modulkürzel: inf178
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls: Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen: Winter, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents: See the assigned course description
Literaturempfehlungen: As announced in course

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel / module level: BC (Basiscurriculum / Base curriculum)
Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method: 2 Veranst. aus V, S, Ü, P, PR (4SWS)

Vorkenntnisse / Previous knowledge:
Examination: Prüfungszeiten
Type of examination: Portfolio or presentation or oral exam
Final exam of module: At the end of the lecture period
Form of instruction: VA-Auswahl
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<tr>
<td>Frequency</td>
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<td>Workload Präsenzzeit</td>
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inf179 - Special Topics in 'Software Engineering' II

Module label: Special Topics in 'Software Engineering' II
Modulkürzel: inf179
Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Praktische Informatik

Zuständige Personen:
Winter, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents
See the assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modullevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:
- 2 Veranst. aus V, S, Ü, P, PR (4SWS)

Vorkenntnisse / Previous knowledge

Examination:
Prüfungszeiten
Type of examination

Final exam of module:
At the end of the lecture period
Portfolio or presentation or oral exam

Form of instruction: VA-Auswahl
<table>
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</table>
inf180 - Current Topics in 'Software Engineering' I

Module label: Current Topics in 'Software Engineering' I
Modulkürzel: inf180
Credit points: 3.0 KP
Workload: 90 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Praktische Informatik

Zuständige Personen:
- Winter, Andreas (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
This module integrates current developments in the field in adequate study courses.

Professional competences:
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences:
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences:
The students:
- communicate with users and experts convincingly

Self-competences:
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents:
See assigned course description

Literaturempfehlungen:
As announced in course

Links:

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

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

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination
Final exam of module:
At the end of the lecture period
Presentation or oral exam
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</table>
inf181 - Current Topics in 'Software Engineering' I

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
S oder V

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture periode
Presentation or oral exam
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</table>
### Module label
Special Topics in 'System Software and Distributed Systems' I

### Modulkürzel
inf182

### Credit points
6.0 KP

### Workload
180 h

### Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Praktische Informatik

### Zuständige Personen
Theel, Oliver (Module responsibility)

Lehrende, Die im Modul (Prüfungsberechtigt)

### Prerequisites
This module integrates current developments in the field in adequate study courses.

#### Professional competences
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:

- support team process by their abilities

#### Self-competences
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

### Module contents
According to the assigned course, e.g. „Verteilte Systeme“, „Realzeitbetriebssysteme“ or „Drahtlose Rechnernetze“

### Literaturempfehlungen
As announced in course

### Links

#### Language of instruction
German

#### Duration (semesters)
1 Semester

#### Module frequency
unregelmäßig

#### Module capacity
unlimited

#### Modullevel / module level
AS (Akzentsetzung / Accentuation)

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

#### Lehr-/Lernform / Teaching/Learning method
2 Veranst. aus V, S, Ü, P, PR (4SWS)

### Vorkenntnisse / Previous knowledge

### Examination
Prüfungszeiten

#### Type of examination

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<p>| 57 / 373 |</p>
<table>
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<th>Form of instruction</th>
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### inf183 - Special Topics in 'System Software and Distributed Systems' II

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<td>Verwendbarkeit des Moduls</td>
<td>• Master's Programme Computing Science (Master) &gt; Praktische Informatik</td>
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<tr>
<td>Zuständige Personen</td>
<td>Theel, Oliver (Module responsibility)</td>
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<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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<td>Prerequisites</td>
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#### Professional competences

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences

The students:

- support team process by their abilities

#### Self-competences

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

### Module contents

According to the assigned course, e.g. „Verteilte Systeme“, „Realzeitbetriebssysteme“ or „Drahtlose Rechnernetze“

### Literaturempfehlungen

As announced in course

### Links

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modulelevel / module level: BC (Basiscurriculum / Base curriculum)
- Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
- Lehr-/Lernform / Teaching/Learning method: V+Ü

### Vorkenntnisse / Previous knowledge

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inf184 - Current Topics in 'System Software and Distributed Systems' I

Module label | Current Topics in 'System Software and Distributed Systems' I
Modulkürzel | inf184
Credit points | 3.0 KP
Workload | 90 h
Verwendbarkeit des Moduls
• Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen
Theel, Oliver (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:

• define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
• recognise and evaluate applied techniques and methods of their subject and are aware of their limits
• 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
• 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 competences
The students:

• examine tasks with technical and research literature, write an academic article and present their solutions academically
• evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
• schedule time processes and resources

Social competences
The students:

• communicate with users and experts convincingly

Self-competences
The students:

• pursue the overall and special computer science development critically
• develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | unregelmäßig
Module capacity | unlimited
Modulelevel / module level | BC (Basiuscurriculum / Base curriculum)
Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method | S or V

Vorkenntnisse / Previous knowledge

Examination | Prüfungszeiten | Type of examination
Final exam of module | Presentation or oral exam
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inf185 - Current Topics in 'System Software and Distributed Systems' II

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Praktische Informatik

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

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:
- communicate with users and experts convincingly

**Self-competences**
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description

**Literaturespfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
S oder V

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Final exam of module**
At the end of the lecture period

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<table>
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inf189 - Special Topics in Practical Computer Science I

Module label: Special Topics in Practical Computer Science I

Modulkürzel: inf189

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Praktische Informatik

Zuständige Personen:
- Lehrenden, Die im Modul (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module:
- Das Modul hat zum Ziel aktuelle Entwicklungen im Vertiefungsgebiet XYZ in den jeweils angemessenen Lehrveranstaltungsformen in das Studium zu integrieren.
- **Fachkompetenzen**
  - Die Studierenden: - differenzieren und kontrastieren einen Teilbereich der Informatik, auf den sie sich spezialisiert haben, im Detail genauer oder reflektieren die Informatik im Allgemeinen - erkennen und beurteilen die in ihrem Spezialgebiet anzuwendenden Techniken und Methoden und deren Grenzen - identifizieren, strukturieren und lösen Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin - wenden dem Stand der Wissenschaft entsprechende und innovative Methoden bei der Untersuchung und Lösung von Problemen an, gegebenenfalls unter Rückgriff auf andere Disziplinen - erkennen die Grenzen des heutigen Wissensstands und der heutigen Technik und tragen zur weiteren wissenschaftlichen und technologischen Entwicklung der Informatik bei - diskutieren aktuelle Entwicklungen der Informatik und beurteilen deren Bedeutung
- **Methodenkompetenzen**
  - Die Studierenden: - untersuchen Probleme anhand technischer und wissenschaftlicher Literatur verfassen nach wissenschaftlichen Gesichtspunkten einen Artikel und präsentieren ihre Ergebnisse in einem wissenschaftlichen Vortrag - reflektieren Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin und wenden Informatik-Methoden zur Untersuchung und Lösung an - planen zeitliche Abläufe und andere Ressourcen Sozialkompetenzen
- Die Studierenden: - kommunizieren überzeugend mündlich und schriftlich mit Anwendern und Fachleuten Selbstkompetenzen
- Die Studierenden: - verfolgen die weitere Entwicklung in der Informatik allgemein und in ihrem Spezialgebiet kritisch entwickeln und reflektieren eigene Theorien zu selbständig aufgestellten Hypothesen

Module contents:
- In diesem Modul werden aktuelle Themen aus dem Gebiet Rechnernetze udn Telekommunikation angeboten. Einzelheiten zu Zielen und Inhalten entnehmen Sie bitte der zugeordneten Veranstaltung oder wenden Sie sich direkt an den Lehrenden

Literaturempfehlungen:
- je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Links:
- German
- 1 Semester
- unregelmäßig
- unlimited
- je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Modulelevel / module level:
- V oder S

Lehr-/Lernform / Teaching/Learning method:
- Seminar

SWS: 2

Frequency: 28 h
inf191 - Special Topics in Practical Computer Science II

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<td>6.0 KP</td>
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<td>Workload</td>
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Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Praktische Informatik

Zuständige Personen

Prerequisites

Skills to be acquired in this module
Das Modul hat zum Ziel aktuelle Entwicklungen im Vertiefungsgebiet "Zuverlässige Systeme" II in den jeweils angemessenen Lehrveranstaltungsformen in das Studium zu integrieren.

Fachkompetenzen
Die Studierenden:
- differenzieren und kontrastieren einen Teilbereich der Informatik, auf den sie sich spezialisiert haben, im Detail genauer oder reflektieren die Informatik im Allgemeinen
- erkennen und beurteilen die in ihrem Spezialgebiet anzuwendenden Techniken und Methoden und deren Grenzen
- identifizieren, strukturieren und lösen Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin
- wenden dem Stand der Wissenschaft entsprechende und innovative Methoden bei der Untersuchung und Lösung von Problemen an, gegebenenfalls unter Rückgriff auf andere Disziplinen
- erkennen die Grenzen des heutigen Wissenstands und der heutigen Technik und tragen zur weiteren wissenschaftlichen und technologischen Entwicklung der Informatik bei
- diskutieren aktuelle Entwicklungen der Informatik und beurteilen deren Bedeutung

Methodenkompetenzen
Die Studierenden:
- evaluieren Werkzeuge, Technologien und Methoden und wenden diese differenziert an
- entwickeln kreativ neue und originäre Vorgehensweisen und Methoden
- reflektieren Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin und wenden Informatik-Methoden zur Untersuchung und Lösung an

Sozialkompetenzen
Die Studierenden:
- integrieren ihre Fähigkeiten in Teamprozesse

Selbstkompetenzen
Die Studierenden:
- verfolgen die weitere Entwicklung in der Informatik allgemein und in ihrem Spezialgebiet kritisch führen innovative Tätigkeiten in ihrem Berufsfeld erfolgreich und eigenverantwortlich aus

Module contents
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Literaturrempfehlungen
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level

Modulart / typ of module
Lehr-/Lernform / Teaching/Learning method
2 Veranstaltungen aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
Am Ende der Vorlesungszeit nach Absprache mit dem Lehrenden
Fachpraktische Übungen oder Referat oder mündliche Prüfung

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance

| Lecture | 2 | 28 |
| Exercises | 2 | 28 |

Präsenzzeit Modul insgesamt
56 h
Theoretische Informatik

inf300 - Hybrid Systems

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<td>Workload</td>
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Verwendbarkeit des Moduls

- Master’s Programme Computing Science (Master) > Technische Informatik
- Master’s Programme Computing Science (Master) > Theoretische Informatik
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen

Fränzle, Martin Georg (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites


Skills to be acquired in this module

The module gives an introduction to hybrid discrete-continuous systems, as arising by embedding digital hardware into physical environments, and it elaborates on state of the art methods for the mathematical modelling and the analysis of such systems. It thus provides central competences for understanding and designing reliable cyber-physical systems.

Professional competence

The students:

- characterise formal models of cyber-physical systems: hybrid automata, hybrid state transition systems
- name domain-specific system requirements: safety, stability, robustness
- name analysis methods: symbolic state-space exploration, abstraction and abstraction refinement, generalized Lyapunov-Methods
- use state-of-the-art analysis tools
- select and apply adequate modelling and analysis methods for concrete application scenarios
- apply methods to reduce large state spaces and reduce infinite-state systems by abstraction
- know the de-facto industry standards for system modelling and are able to apply the corresponding modelling frameworks and tools

Methodological competence

The students:

- model heterogeneous dynamical systems with adequate modelling and design tools, in particular Simulink/Stateflow
- transfer modelling and analysis methods to other heterogeneous domains, e.g. socio-technical systems

Social competence

The students:

- work in teams
- solve complex modelling, design, and analysis tasks in teams

Self-competence

The students:

- reflect their actions and respect the scope of methods dedicated to hybrid systems

Module contents

Embedded computer systems continuously interact with their environment, which generally comprises state- and time-continuous components. The coupling of the embedded system to its environment thus induces complex interleavings between discrete computational and decision processes and continuous processes. The resulting processes are neither amenable to the analytic techniques of continuous control nor of discrete mathematics. They instead require a broader, integrated theory: hybrid discrete-continuous systems. The lectures provide an in-depth introduction into a variety of analysis and design methods of these computer-based systems and their recent extensions to cyber-physical systems.

The accompanying hands-on-project enhances the lecture by developing and using design and verification.
Literaturempfehlungen


Links

Languages of instruction: English, German
Duration (semesters): 1 Semester
Module frequency: once a year
Module capacity: unlimited
Module level / module level: AS (Akzentsetzung / Accentuation)
Moduleart / typ of module: V+Ü

Vorkenntnisse / Previous knowledge: Bachelor in Computing Science oder Kenntnisse gewöhnlicher Differentialgleichungen
Examination: Prüfungszeiten / Type of examination
Final exam of module: At the end of the lecture period / Semester project including written work and final presentation

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Präsenzzeit Modul insgesamt: 56 h
inf450 - Correctness of Graph Programs

**Module label**
Correctness of Graph Programs

**Modulkürzel**
inf450

**Credit points**
6.0 KP

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Theoretische Informatik

**Zuständige Personen**
Lehrende, Die im Modul (Prüfungsberechtigt)
Lehrende, Die im Modul (Module responsibility)

**Prerequisites**
The objectives of this module are modelling of systems, system changes and system properties. Introduction to graph programs. Introduction into system correctness. Methods for proving system correctness.

**Professional competence**
The students:
- Describe the basics of graph programs and graph properties
- Describe verification procedures of system correctness

**Methodological competence**
The students:
- Model systems, system changes and system properties
- Apply the formalism of graph programs

**Social competence**
The students:
- Solve problems in a team
- Present and discuss their proposed solutions

**Self-competence**
The students:
- Reflect upon their actions with regard to term rewriting systems and the methods of those

**Module contents**
The module is an introduction to the modelling of systems, system changes and system properties by means of graphs, graph programs and graph conditions and presents a method for proving correctness of systems with respect to a pre- and a postcondition.

The basic structures used in this lecture are graphs; they are used in practically all domains of computing science for the representation of complex structures. Graph programs are constructed from the core constructs of nondeterministic rule application, sequential composition and iteration and they can effect programmatic changes of a graph structure. One well-known method for determining the correctness of programs with respect to a pre- and a postcondition is based on the construction of a weakest precondition of the postcondition with respect to the program and the attempt to decide whether the given precondition implies the computed weakest precondition.

**Literaturempfehlungen**

**Links**
**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
im 2-Jahres-Zyklus

**Module capacity**
unlimited
**Reference text**  
Wird oft als Blockveranstaltung angeboten

**Modullevel / module level**  
AC (Aufbaucurriculum / Composition)

**Modulart / typ of module**  
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**  
- inf400 Theoretische Informatik I  
- inf401 Theoretische Informatik II

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**Präsenzzeit Modul insgesamt**  
56 h
inf451 - Complexity Theory

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Skills to be acquired in this module

This module covers the computational complexity of algorithms. Complexity considerations are concerned with the time, the memory, and the parallelism required or allowed, for solving an algorithmic problem. In particular, one is interested in lower and/or upper time and space bounds, and in approximative investigations providing information about entire classes of algorithms. For any concrete problem, complexity theory aims at being able to find out which class it belongs to, and thus estimating the cost of the most efficient methods of solving it. Methods taught in this module are general, not depending on any particular algorithmic model or chosen programming language.

Professional competence
The students:

- use Turing machines and variants thereof
- define time, memory, and processor requirements of algorithmic problems
- specify the most relevant complexity classes
- estimate the computational complexity of the most important problems

Methodological competence
The students:

- analyse the complexity of algorithms
- apply techniques of simulation, reduction, and diagonalisation
- compare new problems in terms of complexity

Social competence
The students:

- present proof sketches, proofs, and algorithmic solutions in front of an audience

Module contents

- Mathematical foundations
- Turing machines and register machines
- Space and time hierarchies, equivalence and hierarchy theorems
- Complexity classes: P, NP, NPC, PSPACE, and others
- Alternating automata and polynomial time hierarchy
- Circuit complexity

Literaturempfehlungen

- Eike Best: Skript zur Vorlesung (2015)

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
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inf453 - Combination of Specification Techniques

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**Skills to be acquired in this module**

Introduction to the specification languages Z for data, CSP for processes, and their combination CSP-OZ for reactive systems with data and process parts.

**Professional competence**

The students:

- specify data and processes with Z, CSP and CSP-OZ formally
- check data refinement relations formally
- verify CSP-OZ specifications with FDR model checker

**Methodological competence**

The students:

- are able to integrate complementary specification methods

**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 specifying problems

**Module contents**

The course addresses a research trend in formal methods, the combination and integration of different specification methods. It focuses on a concrete combination CSP-OZ of the specification techniques CSP (Communicating Sequential Processes) for processes and Z and Object-Z for data, respectively. Reactive systems are described by CSP-OZ.

As a preparation, the specification languages Z and CSP are described, followed by the combination CSP-OZ with its process-oriented semantics. The concepts of refinement and inheritance and the possibility of automatic verification of a sublanguage of CSP-OZ with the FDR model checker for CSP will be discussed. Finally, the course explains possibilities of extending CSP-OZ for the specification of time-critical systems.

**Topics:**

- specification of complex data and operations in Z, type definition and pattern calculations of Z, data refinement
- specifications of communicating processes in CSP, operational semantics of CSP, three abstract semantic models

for CSP: Trace semantics, failures semantics, failures-divergences semantics, process refinement in the above semantics, FDR model checker for CSP

- combined specification method CSP-OZ, transformational semantics as CSP-process, theorems of refinements,

object-oriented concepts of class and inheritance in CSP-OZ

**Literatureempfehlungen**

**Essential:**

Recommended:

Links
Language of instruction German
Duration (semesters) 1 Semester
Module frequency unregelmäßig
Module capacity unlimited
Modulelevel / module level BC (Basisscriculum / Base curriculum)
Modulart / typ of module je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method
Vorkenntnisse / Previous knowledge - inf400 Theoretische Informatik I
- inf401 Theoretische Informatik II
Examination Prüfungszeiten Type of examination
Final exam of module At the end of the lecture period exercises and oral exam
Form of instruction Comment SWS Frequency Workload of compulsory attendance
Lecture 3 WiSe 42
Exercises 1 WiSe 14
Präsenzzeit Modul insgesamt 56 h
inf454 - Communicating and Mobile Systems

**Module label**
Communicating and Mobile Systems

**Modulkürzel**
inf454

**Credit points**
6.0 KP

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Theoretische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

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

**Prerequisites**

**Skills to be acquired in this module**
Introduction to Milner's Calculus of Communicating Systems (CCS) and the \( \pi \)-calculus.

**Professional competence**
The students:
- Know the theory of the operational semantics of CCS and the \( \pi \)-calculus
- Perform equivalence proofs using simulations and bisimulations
- Specify communicating and mobile systems with CCS and the \( \pi \)-calculus

**Methodological competence**
The students:
- Learn about different views on mobility
- Recognize equivalences as formal means for system correctness

**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**
Communication is one of the basic concepts of computer science. It occurs between computers in a network as well as between components of a computer. The focus of the course is on Robin Milner's \( \pi \)-calculus. It enables a new modelling of communication, taking the location of the communication into account.

The \( \pi \)-calculus can describe the change of data in a computer as well as the sending of messages or even programs along networks like the internet. It is also possible to describe reconfigurable networks. This will be shown using the examples of mobile phones, schedulers, automatic vending machines, data structures, communication protocols, and objects in object-oriented programming. All these applications are backed by the theory of the \( \pi \)-calculus, which is based on operational semantics and a concept of behavioural equivalence. The theory will be explained in a step-by-step manner.

**Topics:**
- different views on mobility
- transition systems with simulations and bisimulations
- Milner's Calculus of Communicating Systems (CCS) and Milner's \( \pi \)-calculus for mobile systems, both with operational semantics, structural congruence, strong equivalence and observational equivalence, relationship between reactions and transitions, solvability of recursive equations
- formal specification of examples of communicating and mobile systems using CCS and the \( \pi \)-calculus
- proof of strong equivalence and observational equivalence of given processes
- specification of dynamic data structures in the \( \pi \)-calculus

**Literaturempfehlungen**

<table>
<thead>
<tr>
<th>Links</th>
<th><a href="http://csd.informatik.uni-oldenburg.de/">http://csd.informatik.uni-oldenburg.de/</a></th>
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inf456 - Real-Time Systems

Module label: Real-Time Systems
Modulkürzel: inf456
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Theoretische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

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

Prerequisites
Skills to be acquired in this module
Introduction to formal methods of the specification and verification of time sensitive systems and their combinations.

Professional competence
The students:
- Learn about different models of time and real-time properties
- Specify and verify real-time systems
- Model real-time systems using Timed Automata and PLC-Automata
- Apply the model checker UPPAAL for the verification of real-time properties
- Specify real-time systems using the Duration Calculus
- Learn about decidability and undecidability results for real-time systems

Methodological competence
The students:
- Recognize logic and automata as adequate forms for describing real-time 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
Examples of time-critical systems are railway control systems, robots, or even gas burners. It is essential for these systems to comply with certain timing conditions. For example, the control of a railway crossing must close the gates not later than 4 seconds after the sensors have reported an approaching train. If the gates are open, they should stay that way for at least 15 seconds to allow for a safe crossing of vehicles.

Different specification methods have been developed to describe such timing conditions. The Duration Calculus developed by Zhou Chaochen in 1991 is one attractive method. It is a logic combined with a calculus, in which the duration of states can be described. The course will introduce the Duration Calculus and will explain its application by means of examples. As further specification method Timed Automata introduced by Alur & Dill in 1994 will be presented. After the specification of real-time system requirements the verification of programs implementing these requirements will follow. The specification methods of the Duration Calculus and Timed Automata are used to describe the real-time behaviour of these programs. The correctness is then proven on the basis of these behavioral descriptions.

Topics:
- discrete and continuous model of time
- logics and automata models for the specification of real-time systems (predicate logic, Duration Calculus, Timed CTL, Timed Automata, PLC-Automata)
- decidability and undecidability results for real-time systems
- model checker UPPAAL for Timed Automata
formal specification of real-time systems using Duration Calculus as well as Timed Automata and PLC-Automata
verification of concrete Timed Automata using the model checker UPPAAL,
transformation of Duration Calculus for discrete time into regular languages
implementability of real-time systems on PLC-like hardware

Literaturempfehlungen

essential:

recommended:

Links

Languages of instruction: German, English
Duration (semesters): 1 Semester
Module frequency: irregular
Module capacity: unlimited
Module level / module level: AS (Akzentsetzung / Accentuation)
Module type / type of module: V+Ü

Previous knowledge: Theoretische Informatik I & II

Examination: Prüfungszeiten

Type of examination: Exercises and written or oral exam

Final exam of module: At the end of the lecture period

Form of instruction: SWS, Frequency, Workload of compulsory attendance

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Insammt 56 h
inf458 - Term Rewriting Systems

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Prerequisites

Skills to be acquired in this module

The objectives of this module are an introduction to (term) rewriting systems, termination and confluence, the undecidable sets of termination and confluence problems, verification procedures of termination and confluence.

Professional competence

The students:

- describe the basics of term rewriting systems
- characterise the undecidability of termination and confluence problems
- describe verification procedures of termination and confluence

Methodological competence

The students:

- apply verification procedures of termination and confluence
- apply Huet’s completion procedure

Social competence

The students:

- solve problems in a team
- present and discuss their results

Self-competence

The students:

- reflect their actions with regard to term rewriting systems and the methods of those

Module contents

The module is an introduction to term rewriting systems and provides verification procedures for termination and confluence. Term rewriting systems, termination and confluence are introduced, the undecidability of termination and confluence problems and the decidability for a set of special term rewriting systems are shown. For this purpose reduction and simplification orders, critical pairs, orthogonality and Huet’s completion procedure are introduced, examined and combined.

Literaturempfehlungen


Links

Language of instruction | German |
Duration (semesters)    | 1 Semester |
Module frequency        | im 2-Jahres-Zyklus |
Module capacity         | unlimited |
Reference text          | Blockveranstaltung |
Modulart / module level | AC (Aufbaucurriculum / Composition) |
Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht |
Lehr-/Lernform / Teaching/Learning method |
### Vorkenntnisse / Previous knowledge

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**Präsenzzeit Modul insgesamt**

56 h
**inf460 - Security**

**Module label**
Security

**Modulkürzel**
inf460

**Credit points**
3.0 KP

**Workload**
90 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Theoretische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
Lehrenden, Die im Modul (Prüfungsberechtigt)
Lehrenden, Die im Modul (Module responsibility)

**Prerequisites**

The goal of this module is to provide a foundation in computer and network security.

**Professional competences:**
The students: - are aware of the threats posed by cyber attacks to computer and network systems - understand the basic principles and mechanisms to protect a system against these threats - are able to apply this knowledge to assess the risk of cyber attacks to a given system as well as to develop and evaluate countermeasures against them

**Methodological competences:**
The students: - carry out a threat and risk assessment - formulate security requirements for a given system - identify and apply standard security solutions to meet them (These are examples, the exact skills depend on the focus chosen by the student.)

**Social competences:**
The students: - are able to master a new topic by self-study and interaction with experts and peers - are able to explain principles and applications of computer security to experts and non-experts - are able to expertly discuss security risks and incidents

**Self-competences:**
The students: - follow up and critically assess current developments in computer security including security incidents - are security aware in their own behaviour, in their assessment of the systems they work with, and those they develop

**Module contents**
This module provides a broad and comprehensive knowledge in computer security. The topics cover threat analysis and attack trees, essential cryptographic tools, user authentication, access control, malware, intrusion detection and prevention, denial-of-service attacks and defences, software security and trusted systems, and network security. Students without prior knowledge in computer security focus on basic principles such as listed above. Students with prior knowledge in computer security can deepen their knowledge by studying real-world examples such as the SSL/TLS protocol. Typically, they will illustrate their topic by discussing a security incident reported in the public domain security news.

**Literaturempfehlungen**

**Links**
- access from http://vhome.offis.de/sby/leef

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
once a year

**Module capacity**
unlimited

**Reference text**
Associated with the module(s): Security of Cyber-Physical Systems

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
S or V

**Vorkenntnisse / Previous knowledge**
- Basic knowledge in security

**Examination**
Prüfungszeiten
Type of examination
Final exam of module
will be specified in class
Presentation and paper, oral exam, or exam (depending on the number of students)

**Form of instruction**
Course or seminar

**SWS**
2
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**Module label**

Security of Cyber-Physical Systems

**Modulkürzel**

inf461

**Credit points**

3.0 KP

**Workload**

90 h

**Verwendbarkeit des Moduls**

- Master's Programme Computing Science (Master) > Theoretische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**

Lehrenden, Die im Modul (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

- **Professional competences:** The students: - are aware of the threats posed by cyber attacks to cyber-physical systems - understand security solutions specific to CPS - know examples of security architectures of CPS - are able to apply this knowledge to assess the risk of cyber attacks to a given CPS as well as to develop a conceptual systems security architecture for it **Methodological competences:** The students: - carry out a threat and risk assessment for a given CPS - formulate security requirements for a given CPS - develop a systems security architecture for a given CPS to meet them (These are examples, the exact skills depend on the focus chosen by the student.) **Social competences:** The students: - are able to master a new topic by self-study and interaction with experts and peers - are able to explain the significance and facets of security for CPS to experts and non-experts - are able to expertly discuss security risks and incidents of CPS **Self-competences:** The students: - follow up and critically assess current developments in the security of CPS including relevant security incidents - are security aware and foster a security culture with respect to CPS and the resulting critical infrastructures

**Module contents**

Embedded systems in the energy, transportation, and health domains are currently undergoing a technological transition towards highly networked automated cyber-physical systems (CPS). Such systems are potentially vulnerable to cyber attacks, and these can have physical impact. This includes targeted sabotage of a plant (e.g. Stuxnet), large-scale sabotage of infrastructure to cause economic damage (e.g. attacks against energy grids), and indiscriminate attacks to cause civilian casualties (e.g. by compromise of transportation systems). In this module we investigate and discuss security principles, solutions, and architectures for CPS as well as real-life security incidents. The topics include distance bounding protocols, location tracking and counter-measures, safety and security engineering of CPS, security in the automotive and maritime domain including car hacking and vehicle-2-x communication, hacking in the medical domain, attacks against energy grids, Stuxnet, CPS and society: benefits, risks, acceptance.

**Literaturempfehlungen**

Recent scientific papers and reports in the public domain news.

**Language of instruction**

English

**Duration (semesters)**

1 Semester

**Module frequency**

once a year

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

S or V

**Vorkenntnisse / Previous knowledge**

Prüfungszeiten

Type of examination

**Final exam of module**

At the end of the lecture period

Presentation and written documentation, oral exam, or exam

**Form of instruction**

Course or seminar

**SWS**

2

**Frequency**

--

**Workload Präsenzeit**

28 h
### inf480 - Special Topics in 'Parallel Systems' I

**Module label**
Special Topics in 'Parallel Systems' I

**Modulkürzel**
inf480

**Credit points**
6.0 KP

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Theoretische Informatik

**Zuständige Personen**
Lehrende, Die im Modul (Module responsibility)
Lehrende, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Skills to be acquired in this module**

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**
The students:

- support team process by their abilities

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**
See assigned course description, e.g. „Automatentheorie und Logik“, „Modelchecking“, „Effiziente Algorithmen“ und „Theorie und Spiele“.

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AC (Aufbaucurriculum / Composition)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
2 Veranst. aus V, Ü, S, P, PR (4SWS)

**Vorkenntnisse / Previous knowledge**

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<tr>
<td>Workload Präsenzzzeit</td>
<td>28 h</td>
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</table>
Software Analysis

Skills to be acquired in this module
Software analyses extract facts about programs from source code. Such facts can be employed by compilers to optimize programs during compilation, but can also be used to verify correctness of programs. The students get to know different analysis methods, specify such techniques themselves and implement them.

Professional competences
The students:
- get to know data flow analysis and specify them,
- name the components of data flow systems,
- know when to apply widening operators in an analysis,
- are able to develop abstract domains and operators for abstract interpretation,
- know predicate abstraction and the principle of counterexample-guided abstraction refinement,
- know when and how to apply SSA forms,
- are able to judge the precision and scalability of points-to analyses.

Methodological competences
The students:
- are able to formally define analyses,
- are able to prove properties of analyses,
- are able to implement analysis.

Social competences
The students:
- work on tasks in groups and discuss solutions,
- implement analyses in groups.

Self-competences
The students:
- organize their own work for the course.

Module contents
- Data flow analyses
- Abstract interpretation
- Predicate abstraction, CEGAR
- SSA forms
- Slicing
- Points-to analysis
- Symbolic execution

Literaturempfehlungen

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Reference text
Useful previous knowledge: Programming, Logic

Modullevel / module level
AC (Aufbaucurriculum / Composition)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
2 Veranst. aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten

Type of examination

Final exam of module
Weekly homework assignments, lab assignments in a block, oral examination at the end

Form of instruction
VA-Auswahl
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inf482 - Current Topics in 'Parallel Systems' I

Module label: Current Topics in 'Parallel Systems' I
Modulkürzel: inf482
Credit points: 3.0 KP
Workload: 90 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Theoretische Informatik

Zuständige Personen:
Lehrenden, Die im Modul (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
Skills to be acquired in this module:

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:
- communicate with users and experts convincingly

Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents:
See assigned course description

Literaturempfehlungen:
As announced in course

Links

Language of instruction:
German

Duration (semesters):
1 Semester

Module frequency:
unregelmäßig

Module capacity:
unlimited

Modulelevel / module level:
AC (Aufbaucurriculum / Composition)

Modulart / typ of module:
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:
S oder V (2 SWS)

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination

Final exam of module:
At the end of the lecture period
Presentation or oral exam
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inf483 - Current Topics in 'Parallel Systems' II

Module label | Current Topics in 'Parallel Systems' II
---|---
Modulkürzel | inf483
Credit points | 3.0 KP
Workload | 90 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Theoretische Informatik

Zuständige Personen
Lehrenden, Die im Modul (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

*Social competences
The students:
- communicate with users and experts convincingly

Self-competences**
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | unregelmäßig
Module capacity | unlimited

Modullevel / module level | AS (Akzentsetzung / Accentuation)
Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method | S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination | Prüfungszeiten
Type of examination | 
Final exam of module | At the end of the lecture period
Presentation or oral exam |
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inf484 - Special Topics in 'Correct Systems Design' I

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<td>Olderog, Ernst-Rüdiger (Module responsibility) Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**
The students:
- support team process by their abilities

**Self-competences**
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
halbjährlich

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
2 Veranst. aus V, Ü, S, P, PR

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten

**Final exam of module**
Portfolio or presentation or oral exam

**Form of instruction**
VA-Auswahl

92 / 373
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inf485 - Special Topics in 'Correct Systems Design' II

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**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**

The students:

- support team process by their abilities

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**

See assigned course description

<table>
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inf486 - Current Topics in 'Correct Systems Design' I

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</table>

Prerequisites

Skills to be acquired in this module

Professional competences

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences

- communicate with users and experts convincingly

Self-competences

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents

See assigned course description

Literatureempfehlungen

As announced in course

Links

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

unregelmäßig

Module capacity

unlimited

Modulelevel / module level

AS (Akzentsetzung / Accentuation)

Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method

S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination

Prüfungszeiten

Type of examination

Final exam of module

At the end of the lecture period

Presentation or oral exam
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Current Topics in 'Correct Systems Design' II

**Module label**
Current Topics in 'Correct Systems Design' II

**Modulkürzel**
inf487

**Credit points**
3.0 KP

**Workload**
90 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Theoretische Informatik

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

**Prerequisites**

**Skills to be acquired in this module**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- Define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- Recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- Examine tasks with technical and research literature, write an academic article and present their solutions academically
- Evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- Schedule time processes and resources

**Social competences**
The students:
- Communicate with users and experts convincingly

**Self-competences**
The students:
- Pursue the overall and special computer science development critically
- Develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
S oder V (2SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten

**Final exam of module**
At the end of the lecture period

**Type of examination**
Presentation or oral exam
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**inf488 - Special Topics in 'Formal Languages' I**

**Module label**
Special Topics in 'Formal Languages' I

**Modulkürzel**
inf488

**Credit points**
6.0 KP

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Theoretische Informatik

**Zuständige Personen**
Lehrende, Die im Modul (Module responsibility)
Lehrende, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**
The students:

- support team process by their abilities

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
2 Veranst. aus V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**

**Prüfungszeiten**
Type of examination

**Final exam of module**
At the end of the lecture period
Portfolio or presentation or oral exam

**Form of instruction**
VA-Auswahl
<table>
<thead>
<tr>
<th>SWS</th>
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<tbody>
<tr>
<td>Frequency</td>
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<tr>
<td>Workload Präsenzzeit</td>
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inf489 - Special Topics in 'Formal Methods'

<table>
<thead>
<tr>
<th>Module label</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>inf489</td>
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<tr>
<td>Credit points</td>
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<td>Zuständige Personen</td>
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<tr>
<td></td>
<td>Lehrenden, Die im Modul (Module counselling)</td>
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</table>

**Prerequisites**

**Skills to be acquired in this module**

This module integrates current computer science developments into the informatics program, especially considering the selected focus area, by appropriate study courses

**Professional competences**

The students:

- know recent technological or scientific computer science developments
- transfer computer science methods and development models to IT application area requirements
- evaluate the possibilities and limitations of computer science methods and tools and
- apply them appropriately.

**Methodological competences**

The students:

- review problems, formulate them with formal models and explore them appropriately
- identify and present (one or more) computer science problem solutions
- select and evaluate appropriate tools and methods
- examine problems with technical and scientific literature

**Social competences**

The students:

- cooperate in a team

**Self-competences**

The students:

- plan their informatical actions independently

**Module contents**

According to the assigned task

**Literaturempfehlungen**

According to the assigned task

**Links**

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modullevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method: 2 Veranst. aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge

Examination Prüfungszeiten Type of examination

Final exam of module
At the end of the lecture period Portfolio or presentation or oral exam or written exam

Form of instruction VA-Auswahl

SWS 2
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inf490 - Current Topics in 'Formal Methods'

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<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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<tr>
<td>Prerequisites</td>
<td>This module integrates current developments in the field in adequate study courses.</td>
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</table>

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**

The students:

- communicate with users and experts convincingly

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**

See assigned course description

**Literaturempfehlungen**

As announced in course

**Links**

German

**Language of instruction**

1 Semester

**Duration (semesters)**

half-yearly

**Module frequency**

unlimited

**Module capacity**

AS (Akzentsetzung / Accentuation)

**Module level / module level**

je nach Studiengang Pflicht oder Wahlpflicht

**Modulart / typ of module**

S oder V (2 SWS)

**Lehr-/Lernform / Teaching/Learning method**

Prüfungszeiten

**Type of examination**

Presentation or oral exam

**Vorkenntnisse / Previous knowledge**

At the end of the lecture period

**Final exam of module**
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**inf491 - Current Topics in 'Formal Languages' II**

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</table>

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**

The students:

- communicate with users and experts convincingly

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**

See assigned course description

**Literaturempfehlungen**

As announced in course

**Links**

<table>
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**Vorkenntnisse / Previous knowledge**

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<td>Presentation or oral exam</td>
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inf494 - Current Topics in 'Modeling and Analysis of Complex Systems' I

<table>
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<td>Lehrenden, Die im Modul (Module responsibility)</td>
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### Prerequisites

This module integrates current developments in the field in adequate study courses.

#### Professional competences

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

#### Social competences

The students:

- communicate with users and experts convincingly

#### Self-competences

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

### Module contents

See assigned course description, e.g. „Security: Grundlagen“ oder „Security for Cyberphysical Systems“

### Literatureempfehlungen

As announced in course

### Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modulelevel / module level: AS (Akzentsetzung / Accentuation)

Modułat / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method: S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination: Prüfungszeiten

Type of examination: Presentation or oral exam

Final exam of module: At the end of the lecture period
<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Course or seminar</th>
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<tr>
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<td>SoSe oder WiSe</td>
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<td>28 h</td>
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</table>
inf495 - Current Topics in 'Modeling and Analysis of Complex Systems' II

Module label: Current Topics in 'Modeling and Analysis of Complex Systems' II
Modulkürzel: inf495
Credit points: 3.0 KP
Workload: 90 h
Verwendbarkeit des Moduls: • Master's Programme Computing Science (Master) > Theoretische Informatik
Zuständige Personen:
Lehrenden, Die im Modul (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module: This module integrates current developments in the field in adequate study courses.

Professional competences
The students:

• define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
• recognise and evaluate applied techniques and methods of their subject and are aware of their limits
• 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
• 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 competences
The students:

• examine tasks with technical and research literature, write an academic article and present their solutions academically
• evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
• schedule time processes and resources

Social competences
The students:

• communicate with users and experts convincingly

Self-competences
The students:

• pursue the overall and special computer science development critically
• develop and reflect self-developed hypotheses to theories independently

Module contents: See assigned course description, e.g. „Security: Grundlagen“ oder „Security for Cyberphysical Systems“
Literaturempfehlungen: As announced in course
Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modulelevel / module level: AS (Akzentsetzung / Accentuation)
Modutarü / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method: S oder V (2 SWS)
Vorkenntnisse / Previous knowledge
Examination: Prüfungszeiten
Type of examination
Final exam of module: At the end of the lecture period
Presentation or oral exam
<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Course or seminar</th>
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<tbody>
<tr>
<td>SWS</td>
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<td>SoSe oder WiSe</td>
</tr>
<tr>
<td>Workload Präsenzzeit</td>
<td>28 h</td>
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</table>
Model Checking

Model checking is a technique for the automatic verification of hardware and software systems. In the course, the students develop knowledge and skills in requirements specification via temporal logic and the automatic algorithmic checking of systems with respect to requirements.

**Professional competence**

The students:
- name the operators in temporal logics and the differences between linear-time and branching-time logics,
- specify requirements in LTL and CTL,
- translate LTL formulae to Büchi automata,
- construct BDDs for boolean functions,
- describe CTL formulae in fixpoint form,
- apply model checking algorithms to Kripke structures,
- know the expressivity of bisimulation

**Methodological competence**

The students:
- apply formal modelling techniques,
- prove properties of temporal logics,
- use model checking tools for the verification of systems.

**Social competence**

The students:
- work on tasks in groups and discuss solutions,
- develop system descriptions in groups and interpret results of tools.

**Self-competence**

- organize their own work for the course.

Module contents

- temporal logics LTL and CTL
- Büchi automata
- explicit model checking
- Binary decision diagrams
- Lattices, fixpoints, CTL as transformers
- Symbolic model checking
- bisimulation

Literaturempfehlungen

Christel Baier, Joost-Pieter Katoen: Principles of Model Checking, MIT Press
E. M. Clarke, Orna Grumberg, Doron Peled: Model Checking, MIT Press

Links

Languages of instruction

German, English
<table>
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**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

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<th>Type of examination</th>
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<td>Portfolio</td>
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**Form of instruction**

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<td>SoSe oder WiSe</td>
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<td>Exercises</td>
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<td>SoSe oder WiSe</td>
<td>28</td>
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| Präsenzzeit Modul insgesamt | 56 h |
inf493 - Special Topics in Theoretical Computer Science II

Module label
Special Topics in Theoretical Computer Science II

Modulkürzel
inf493

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
• Master's Programme Computing Science (Master) > Theoretische Informatik

Zuständige Personen
Sonnenschein, Michael (Module responsibility)
Lehrenden, Die im Modul (Module counselling)

Prerequisites
Skills to be acquired in this module
Das Modul hat zum Ziel aktuelle Entwicklungen im Vertiefungsgebiet XYZ in den jeweils angemessenen Lehrveranstaltungsformen in das Studium zu integrieren.

Fachkompetenzen
Die Studierenden:
- differenzieren und kontrastieren einen Teilbereich der Informatik, auf den sie sich spezialisiert haben, im Detail genauer oder reflektieren die Informatik im Allgemeinen
- erkennen und beurteilen die in ihrem Spezialgebiet anzuwendenden Techniken und Methoden und deren Grenzen
- identifizieren, strukturieren und lösen Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin
- wenden dem Stand der Wissenschaft entsprechende und innovative Methoden bei der Untersuchung und Lösung von Problemen an, gegebenenfalls unter Rückgriff auf andere Disziplinen
- erkennen die Grenzen des heutigen Wissenstands und der heutigen Technik und tragen zur weiteren wissenschaftlichen und technologischen Entwicklung der Informatik bei
- diskutieren aktuelle Entwicklungen der Informatik und beurteilen deren Bedeutung

Methodenkompetenzen
Die Studierenden:
- evaluieren Werkzeuge, Technologien und Methoden und wenden diese differenziert an
- entwickeln kreativ neue und originäre Vorgehensweisen und Methoden
- reflektieren Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin und wenden Informatik-Methoden zur Untersuchung und Lösung an

Sozialkompetenzen
Die Studierenden:
- integrieren ihre Fähigkeiten in Teamprozesse

Selbstkompetenzen
Die Studierenden:
- verfolgen die weitere Entwicklung in der Informatik allgemein und in ihrem Spezialgebiet kritisch
- führen innovative Tätigkeiten in ihrem Berufsfeld erfolgreich und eigenverantwortlich aus

Module contents
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Literaturempfehlungen
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modullevel / module level

Modulart / typ of module

Lehr-/Lernform / Teaching/Learning method
2 Veranstaltungen aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
Fachpraktische Übung und mündliche Prüfungen oder Klausur

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance
Lecture
2
28
Exercises
2
28

Präsenzzeit Modul insgesamt
56 h
inf492 - Special Topics in Theoretical Computer Science I

Module label: Special Topics in Theoretical Computer Science I
Modulkürzel: inf492
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls
• Master's Programme Computing Science (Master) > Theoretische Informatik

Zuständige Personen
Lehrenden, Die im Modul (Module counselling)

Prerequisites
Skills to be acquired in this module
Das Modul hat zum Ziel aktuelle Entwicklungen im Vertiefungsgebiet "Modellierung und Analyse komplexer Systeme" I in den jeweils angemessenen Lehrveranstaltungsformen in das Studium zu integrieren.
Fachkompetenzen
Die Studierenden:
- differenzieren und kontrastieren einen Teilbereich der Informatik, auf den sie sich spezialisiert haben, im Detail genauer oder reflektieren die Informatik im Allgemeinen
- erkennen und beurteilen die in ihrem Spezialgebiet anzuwendenden Techniken und Methoden und deren Grenzen
- identifizieren, strukturieren und lösen Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin
- wenden dem Stand der Wissenschaft entsprechende und innovative Methoden bei der Untersuchung und Lösung von Problemen an, gegebenenfalls unter Rückgriff auf andere Disziplinen
- erkennen die Grenzen des heutigen Wissenstands und der heutigen Technik und tragen zur weiteren wissenschaftlichen und technologischen Entwicklung der Informatik bei
- diskutieren aktuelle Entwicklungen der Informatik und beurteilen deren Bedeutung
Methodenkompetenzen
Die Studierenden:
- evaluieren Werkzeuge, Technologien und Methoden und wenden diese differenziert an
- entwickeln kreativ neue und originäre Vorgehensweisen und Methoden
- reflektieren Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin und wenden Informatik-Methoden zur Untersuchung und Lösung an
Sozialkompetenzen
Die Studierenden:
- integrieren ihre Fähigkeiten in Teamprozesse
Selbstkompetenzen
Die Studierenden:
- verfolgen die weitere Entwicklung in der Informatik allgemein und in ihrem Spezialgebiet kritisch führen innovative Tätigkeiten in ihrem Berufsfeld erfolgreich und eigenverantwortlich aus

Module contents
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Literaturempfehlungen
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Links
Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig
Module capacity: unlimited

Modullevel / module level

Modulart / typ of module
Lehr-/Lernform / Teaching/Learning method
2 Veranstaltungen aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge

Examination Prüfungszeiten Type of examination
Final exam of module Fachpraktische Übung und mündliche Prüfungen oder Klausur

Form of instruction Comment SWS Frequency Workload of compulsory attendance
Lecture 2 28
Exercises 2 28

Präsenzzeit Modul insgesamt 56 h
**Technische Informatik**

**inf300 - Hybrid Systems**

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</table>

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Computing Science (Master) > Theoretische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Fränzle, Martin Georg (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
The module gives an introduction to hybrid discrete-continuous systems, as arising by embedding digital hardware into physical environments, and it elaborates on state of the art methods for the mathematical modelling and the analysis of such systems. It thus provides central competences for understanding and designing reliable cyber-physical systems.

**Professional competence**
The students:
- characterise formal models of cyber-physical systems: hybrid automata, hybrid state transition systems
- name domain-specific system requirements: safety, stability, robustness
- name analysis methods: symbolic state-space exploration, abstraction and abstraction refinement, generalized Lyapunov-Methods
- use state-of-the-art analysis tools
- select and apply adequate modelling and analysis methods for concrete application scenarios
- apply methods to reduce large state spaces and reduce infinite-state systems by abstraction
- know the de-facto industry standards for system modelling and are able to apply the corresponding modelling frameworks and tools

**Methodological competence**
The students:
- model heterogeneous dynamical systems with adequate modelling and design tools, in particular Simulink/Stateflow
- transfer modelling and analysis methods to other heterogeneous domains, e.g. socio-technical systems

**Social competence**
The students:
- work in teams
- solve complex modelling, design, and analysis tasks in teams

**Self-competence**
The students:
- reflect their actions and respect the scope of methods dedicated to hybrid systems

**Module contents**
Embedded computer systems continuously interact with their environment, which generally comprises state- and time-continuous components. The coupling of the embedded system to its environment thus induces complex interleavings between discrete computational and decision processes and continuous processes. The resulting processes are neither amenable to the analytic techniques of continuous control nor of discrete mathematics. They instead require a broader, integrated theory: hybrid discrete-continuous systems. The lectures provide an in-depth introduction into a variety of analysis and design methods of these computer-based systems and their recent extensions to cyber-physical systems.

The accompanying hands-on-project enhances the lecture by developing and using design and verification...
Literaturempfehlungen


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Form of instruction | Comment | SWS | Frequency | Workload of compulsory attendance |
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Präsenzzeit Modul insgesamt | 56 h |
inf301 - Machine-oriented Systems Engineering

Module label: Machine-oriented Systems Engineering

Modulkürzel: inf301

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls

- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen

Mikschl, Alfred (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

The module provides practical relevance to the design of digital embedded systems.

Professional competence

The students:

- characterise the structure of microprocessor systems
- name control aspects of time sensitive external components
- program efficient embedded systems

Methodological competence

The students:

- use specifications from electrical components data sheets

Social competence

The students:

- work in a team
- discuss solutions

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 initial review of computer architectures. After that embedded systems are introduced by a specific microprocessor. Furthermore, external hardware will be connected to the microprocessor. Besides this, the design of circuit boards will be discussed. The students will design, develop and implement a circuit layout with CAD and programme this embedded system with a Flash-eprom.

Literaturempfehlungen

Lecturers notes, hardware manuals and data sheets, and development tool manuals

Links

Languages of instruction: English, German

Duration (semesters): 1 Semester

Module frequency: semi-annual

Module capacity: unlimited

Modullevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: V+P

Vorkenntnisse / Previous knowledge

Examination: Prüfungszeiten

Final exam of module: At the end of the lecture period

Type of examination: Portfolio (Design, development and implementation of embedded systems, colloquium)
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<td><strong>56 h</strong></td>
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inf303 - Fuzzy Control and Artificial Neural Networks in Robotics and Automation

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<tr>
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<td>Workload</td>
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Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen
Fatikow, Sergej (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
Experts in different branches try to approach their application-specific control and information processing problems by using fuzzy logic and artificial neural networks (ANN). The experiences gathered up to now prove robotics and automation technology to be predestined fields of application of both these approaches. The major topics of the course are control problems in robotics and automation technology, principles of fuzzy logic and ANN and their practical applications, comparison of conventional and advanced control methods, combination of fuzzy logic and ANN in control systems. The course gives a comprehensive treatment of these advanced approaches for interested students.

Professional competence
The students:

- recognise control problems in robotics and automation technology,
- name principles of fuzzy logic and ANN and their practical applications,
- compare conventional and advanced control methods,
- characterise the combination of fuzzy logic and ANN in control systems

Methodological competence
The students:

- will acquire knowledge of the tools, methods and applications in fuzzy logic and ANN
- deepen their knowledge for the practical use of the given methods
- can use common software tools for design and application of fuzzy logic and ANN

Social competence
The students:

- gain experience in interdisciplinary work
- are integrated into the recent research work

Objective of the module / skills:

Self-competence
The students:

- are able to transfer the gained knowledge for later use in their theses or studies for AMiR
- can Design (complex) fuzzy logic controller and ANN systems
- reflect their (control) solutions by using methods learned in this course

Module contents

- Control problems in robotics and automation technology
- Basic ideas of fuzzy logic and ANN
- Principles of fuzzy logic
- Fuzzy logic of rule-based systems
- ANN models
- ANN learning rules
- Multilayer perceptron networks and backpropagation
- Associative networks
- Self-organizing feature maps
- PID design principles
- Design of fuzzy control systems
- Fuzzy logic application examples
- Design of ANN control systems
- ANN application examples
- Fuzzy + Neuro: principles and applications

**Literaturempfehlungen**

**Essential:**

- Lecture notes (available at the secretariat, A1-3-303) in book form

**Recommended:**


**Secondary Literature:**

- Altrock, M. O. R.: Fuzzy Logic, R. Oldenbourg Verlag, 1993
- Kahler, J. und Hubert, F.: Fuzzy-Logik und Fuzzy-Control, Vieweg, 1993
- Kratzer, K.P.: Neuronale Netze, Carl Hanser, 1993
- Lawrence, J.: Neuronale Netze, Sytshema Verlag, München, 1992
- Patterson, D.W.: Künstliche neuronale Netze, Prentice Hall, 1996
- Pham, D.T.: Fuzzy Logic: Technologie, Oldenbourg, 1993
- Altrock, M. O. R.: Fuzzy Logic, R. Oldenbourg Verlag, 1993
- Schulte, U.: Einführung in Fuzzy-Logik, Franzis-Verlag, München, 1993
- Zimmermann H.-J. (Hrsg.): Datenanalyse, VDI-Verlag, 1995

**Links**

**Languages of instruction**

- English, German

**Duration (semesters)**

- 1 Semester

**Module frequency**

- once a year

**Module capacity**

- unlimited

**Modullevel / module level**

- AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

- V+Ü

**Vorkenntnisse / Previous knowledge**

- Regelungstechnik

**Lehr-/Lernform / Teaching/Learning method**

**Examination**

- Prüfungszeiten
- Type of examination

**Final exam of module**

- At the end of the lecture period until the beginning of the next semester
- Hands-on-exercises and oral Exam

**Form of instruction**

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<th>Workload of compulsory attendance</th>
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<td></td>
<td>56 h</td>
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</table>
inf305 - Medical Technology

Module label | Medical Technology
Modulkürzel | inf305
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen
Hein, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

Professional competence
The students:
- Describe medical diagnosis and therapy methods
- Understand the core concepts of computer-assisted medical interventions
- Are aware of the basic concepts and legal conditions of the development of medical devices
- Define the character of medical devices' software parts and implement them
- Assess the complex interaction of medical products and patients
- Get familiar with the development of medical products within a short period of time

Methodological competence
The students:
- Recognise the interdisciplinary challenges and accordingly exchange information with other disciplines

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

- Medical areas and areas of application
- Basic requirements for medical systems (hygiene, MPG, technical security, materials)
- Medical systems:
  - Functional diagnostics (ECG, EMG, EEG)
  - Imaging systems (CT, MRI, ultrasound, PET, SPECT) - Therapy equipment (Laser, RF, Microtherapy)
  - Signal processing / monitoring (cardiovascular, hemodynamic, respiratory, metabolic, cerebral)
- Medical Informatics (HIS, DICOM, Telemedicine, VR, image processing).

Literaturempfehlungen

essential:
- Lecture slides

recommended:
secondary literature:


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| Vorkenntnisse / Previous knowledge | - Signal und Bildverarbeitung  
- Regelungstechnik |
| Examination | Prüfungszeiten  
Type of examination |
| Final exam of module | At the end of the lecture periode  
Portfolio: Hands-on exercises, report, and written or oral exam |
| Form of instruction | Comment | SWS | Frequency | Workload of compulsory attendance |
| Lecture | 3 | WiSe | 42 |
| Exercises | 1 | WiSe | 14 |
| Präsenzzeit Modul insgesamt | | | 56 h |
**inf307 - Robotics**

**Module label**  
Robotics

**Modulkürzel**  
inf307

**Credit points**  
6.0 KP

**Workload**  
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
Hein, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

**Professional competence**
The students:
- Name and know the functions and applications of robot systems
- Characterise the basic concepts to program robot systems
- Differentiate between the interaction of mechanical, electrical and software components

**Methodological competence**
The students:
- Define characteristics and components of robot systems for a specific application
- Design and implement robot system sub-components
- Design and parameterise simple control structures
- Plan the application of robot systems and derive the requirements
- Model electrical and mechanical systems
- Develop and realise simple robot systems

**Social competence**
The students:
- Solve robot systems problems in team work

**Self-competence**
The students:
- Reflect their solutions in reference to robot system methods

**Module contents**
- Integration in production plants / aims / subsystems
- Architectures / classifications (classification of robots)
- Robot components + Computer systems for programming
  - PA-10
  - Lego Mindstorms
- Basics of kinematics
  - Coordinate transformation, homogeneous coordinates, Coordinate transitions
  - Kinematic equation systems, transformation of vectors
- Kinematic
  - Joint types (manipulators) / Wheels, TCP
  - Denavit-Hartenberg-Transformation
  - Forward calculation
  - Backward calculation
- Sensors
  - General properties of sensors, parameter
  - Simple optical position sensors
  - Inductive-, capacitive- und ultrasonic-sensors
  - Distance sensors (laser scanner, triangulation sensors)
  - Force sensors
  - Sensor data preparation
- Planing / Regulation
  - Overall regulation approach, terms, process- and control functions, PID-controller
  - Planning concepts and approaches (On-Line, Off-Line), planning processes, construction and path planning
- Actuators

**Literaturempfehlungen**

**essential:**
lecture nodes

**recommended:**

**secondary literature:**

**Links**

**Languages of instruction**
German, English

**Duration (semesters)**
1 Semester

**Module frequency**
one a year

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
V+Ü

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten
Type of examination
Final exam of module
At the end of the lecture period
Portfolio: Hands-on exercises, report, and written or oral exam

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**Präsenzzeit Modul insgesamt**
56 h
### inf308 - Microrobotics II

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Fatikow, Sergej (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
After having given an established introduction in the module "Microrobotics and Microsystem Technology" this lecture offers a further specialisation in microrobotics. Within the course, all relevant areas (among others the research topics of the division "Microrobotics and Control Engineering (AMiR)") will be presented and analysed. The student will be provided with an insight into current research projects of AMiR and of other research institutes of microrobotics worldwide; here mainly the requirements of industry to microrobots will be discussed. The lecture will be enhanced by practical courses in the research laboratories of AMiR.

**Professional competence**
The students:
- name and recognise the basic concepts of nanotechnology, in particular, micro- and nanorobotics approaches
- differentiate the development, control and application of micro- and nanorobotics systems
- implement and design application-specific micro- and nanorobotics systems

**Methodological competence**
The students:
- transfer their control engineering and image processing abilities on interdisciplinary problems
- transfer their hands-on experience to develop controls and applications of microrobotic systems on new tasks

**Social competence**
The students:
- work in a team

**Self-competence**
The students:
- reflect their problem-solving behaviour and use hands-on experience to develop, control and application of microrobotics

**Module contents**

- Smart and versatile microrobots; microactuators (piezo-, ferrofluid- and SMA-actuators) for microrobots;
- real-time image processing in the micro world (SEM, optical microscopy);
- micro force sensors and tactile sensors for microrobots; microrobot control systems, e.g. neural networks and fuzzy logic; haptic interface for the control of microrobots;
- neural speech interface for the control of microrobots; robot-based micro- and nanohandling (SEM, optical microscopy);
- applications: microassembly, nano-testing, cell handling; Micro Air Vehicles (MAVs);
- multi-robot systems: team behavior, communication, control issues

**Literaturempfehlungen**
- Lecture notes (can be obtained in secretariate, A1-3-303)

**Links**

**Languages of instruction**
- English, German
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<td>Prüfungszeiten</td>
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**Präsenzzzeit Modul insgesamt** 56 h
inf311 - Low Energy System Design

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<td>Modulkürzel</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>This module introduces the estimation of power dissipation and optimisation.</td>
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<tr>
<td>Professional competence</td>
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<td>The students:</td>
<td></td>
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<tr>
<td>- Discuss the fundamental problems of power dissipation</td>
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<tr>
<td>- Characterise the requirements-driven design process of embedded systems</td>
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<tr>
<td>- Name power loss analysis and optimization methods</td>
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<tr>
<td>- Design embedded systems with common design and analysis tools</td>
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<tr>
<td>- Design power-optimized embedded systems</td>
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<td>Methodological competence</td>
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<td>The students:</td>
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<tr>
<td>- Model systems with a hardware description language</td>
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<tr>
<td>- Analyze and model hardware components</td>
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<tr>
<td>- Perform multi-dimensional optimization of systems</td>
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<td>- Implement solutions of given problems in teams</td>
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<td>- Discuss their outcomes appropriately</td>
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<td>The students:</td>
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<td>- Acknowledge the limits of their ability to cope with pressure during the modeling process of systems</td>
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Module contents

According to Moore’s Law the number of integratable transistors on a computer chip doubles every two years. In addition, new circuits are getting faster and faster. This leads not only to an increased functionality of a system, but it also increases the electrical power consumption.

This electrical power consumption is problematic from two different points of view: Firstly, the electrical power must be supplied. Secondly, the resulting heat has to dissipate from the system. An increased power consumption always causes lower battery life and higher energy costs. The heat generation reduces the reliability and life of integrated circuits. The cooling (ceramic housings, cooling elements, fans, etc.) increases the system’s costs.

Today the development of heat, caused by power dissipation, needs to be considered during the embedded system design process. This knowledge takes the system’s reliability and operation costs into account.

This module introduces the estimation of power dissipation and optimisation.

Literatureempfehlungen

- Designing CMOS Circuits for Low Power – Dimitros Soudris, Christian Piguet, Costas Goutis
- Low-Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad
- Low-Power Electronics Design – Christian Piguet et al.
- Leakage in Nanometer CMOS Technologies – Siva G. Narendra, Anantha Chandrakasan
- Entwurf von digitalen Schaltungen und Systemen mit HDLs und FPGAs – F. Kesel, R. Bartholomä
- Slides of the module „Eingebettete Systeme I+II“ von Professor Dr.-Ing. Wolfgang Nebel
- Slides and technical readouts of the used hardware and development tools
### Links

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                                | - inf201 Technische Informatik,  
                                | - inf203 Eingebettete Systeme I+,  
                                | - inf204 Eingebettete Systeme II |

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| Präsenzzeit Modul insgesamt | 56 h  |
inf331 - Automated and Connected Driving

**Module label**: Automated and Connected Driving

**Modulkürzel**: inf331

**Credit points**: 6.0 KP

**Workload**: 180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction

**Zuständige Personen**
- Köster, Frank (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

**Professional competences:**
The students:
- Discuss different levels of automated driving (e.g., SAE-Level) and the differences
- Discuss different levels of connected driving and the differences
- Discuss core-domains of automated vehicles
- Discuss important technological pillars in the areas sense, plan, and act
- Discuss transition between different levels of automation
- Discuss the impact of connected vehicle functions on automated driving
- Discuss the impact of automated vehicle functions on connected driving
- Characterise the impact of automated and connected driving on road traffic
- Characterise the interaction of humans and automated and connected vehicles
- Design an abstract procedure for the change of different levels of automation
- Design a rough vehicle architecture for automated and connected drivings:

**Methodological competences:**
The students:
- Analyze complex automated and connected vehicles (-> domains)
- Analyze core-functions of automated and connected vehicles (-> functions)

**Social competences:**
The students:
- Work in teams - Discuss their outcomes appropriately

**Self-competences:**
The students:
- Acknowledge the limits of their ability to cope with pressure during the analysis of complex (automated and connected) socio-technical systems

**Module contents**
- levels of automated driving (e.g., SAE-Level)
- levels of connected driving - core-domains of automated vehicles
- sense, plan, and act in the context of automated and connected vehicles
- transition between different levels of automation
- selected connected vehicle functions
- selected automated vehicle functions
- human factors and socio-technical systems
- vehicle architectures

**Literaturempfehlungen**

**Suggested reading:**

**Links**

**Language of instruction**: English

**Duration (semesters)**: 1 Semester

**Module frequency**: Once a year

**Module capacity**: unlimited
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| Präsenzzeit Modul insgesamt | 56 h |
inf332 - Practice Robotics

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Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction

Zuständige Personen
Hein, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

Professional competences:
The students learn:
- Programming of robots (mobile or stationary)
- Implementation of elementary operations
- Integration of operations into a small application scenario
- Programming using Robot Operating System (ROS)

Methodological competences:
The students learn:
- Systematic development process with team members
- Systematic evaluation of the application
- Designing a robotic application using basic and advanced robotic concepts

Social competences:
The students learn:
- Project management
- Team work
- Organization of the team

Self-competences:
The students:
- Time management
- Autodidactic work (literature search, technical specs, related work)

Module contents
Robotic systems will be provided to the students. They will then define the project/application scenario of the robots by their own and complete the project as a small team with self-organization and work distribution among the team members.
The module consists of a lecture and an exercise part:
Lecture: 2-3 lectures for introduction onto the module and introduction into the Robot Operating System (ROS) as well as the concepts of the projects.
Exercises: After the introduction period, the students will work self-organized to complete the proposed project. Work can be distributed weekly or on as concentrated time blocks.

Literaturempfehlungen
John J. Craig, Introduction to Robotics: Mechanics and Control
Patrick Goebel, ROS By Example

Links

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
Once a year

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
V+Ü

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
At the end of the lecture period
Demonstration and written documentation
Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance
Lecture
2
SoSe oder WiSe
28
Exercises
2
SoSe oder WiSe
28

133 / 373
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inf333 - Sensor Technology in the Automotive Domain

Module label: Sensor Technology in the Automotive Domain

Modulkürzel: inf333

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen:
Lehrende, Die im Modul (Prüfungsberechtigt)
Boll-Westermann, Susanne (Module responsibility)

Prerequisites:
Skills to be acquired in this module:

Professional competences:
The students:
- Discuss different levels/diverse levels sensor-technologies
- Discuss sensor-data fusion (multi-level fusion)
- Discuss Kalman-Filter
- Discuss in-vehicle data-processing
- Discuss car2cx-technologies
- Design simple multi-sensor systems
- Evaluate multi-sensor systems

Methodological competences:
The students:
- Analyze multi-sensor systems
- Design multi-sensor systems
- Evaluate multi-sensor systems

Social competences:
The students:
- Work in teams
- Discuss their outcomes appropriately

Self-competences:
The students:
- Acknowledge the limits of their ability to cope with pressure during the work on the topics of the module

Module contents:
- Sensor-technologies
- Data fusion (multi-level fusion)
- Kalman-Filter
- In-vehicle data-processing
- Car2cx-technologies (ITS G5 and 5G)
- Multi-sensor and multi-level fusion architectures

Literaturempfehlungen:

Suggested reading:
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<td>28</td>
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| Präsenzzeit Modul insgesamt | 56 h |
inf334 - System Level Design

Module label: System Level Design
Modulkürzel: inf334
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen:
Lehrenden, Die im Modul (Prüfungsberechtigt)
Lehrenden, Die im Modul (Module responsibility)

Prerequisites:
Skills to be acquired in this module:

Professional competences:
The students:
- Ability to describe and analyze system components and architectures using system level description languages SpecC and SystemC
- Capabilities for partitioning and parallelizing of applications

Methodological competences:
The students:
- Knowledge of refinement and transformation techniques for transferring an initial specification into a real implementation
- Knowledge of the phases of a system-level design flow
- Knowledge of current design methods and tools in system level design
- Knowledge about formal models of computation of specification languages
- Knowledge of current research results and trends in system level design
- Capabilities for partitioning and parallelizing of applications
- Ability to evaluate and explore design decisions
- Ability to implement a complete system design-to-implementation specification

Social competences:
The students:
- Implement solutions of given problems in teams
- Discuss their outcomes appropriately

Self-competences:
The students:
- presentation skills
- reflect their solutions by using methods learned in this course

Module contents:
The ever-increasing integration densities of integrated circuits enable the implementation of increasingly powerful and complex systems. This can be on the one hand the integration of several sub-components on the same chip (system-on-chip) or on the other hand the implementation of more powerful algorithms. However, traditional design techniques are hardly able to cope with the increasing complexity of today’s embedded systems. Therefore, in research and practice efforts through new methods and tools, there is a significant increase in productivity in the design process, thus closing the so-called “design productivity gap”. This is achieved, for example, by a stronger abstraction, in which the behavior of components is described only at the algorithmic level and is automatically translated into hardware or software implementations by high-level synthesis techniques. The final system implementation is achieved by means of a structured refinement and exploration processes. Throughout this refinement flow, system properties (for example, timing, energy consumption, chip area and costs) are estimated on each abstraction level and guide the designer in the iterative decision process. By means of techniques such as virtual prototyping, entire systems can be simulated and verified on each refinement layer, even without the availability of a full implementation for all system components.

This module builds on the modules Embedded Systems I and II, deepens the knowledge acquired there for the design of hardware/software systems and expands them with current methods and tools. With SystemC, a language is presented that is already widely used in industry and research for the design and verification of hardware/software systems and supports several abstraction levels from clock cycle accurate hardware description, over transaction level models to process based functional specifications.
Suggested reading:

Main textbooks:

Optional books:

Additional reading material posted on Stud.IP

Links
https://www.uni-oldenburg.de/informatik/ehs/lehre/vorlesungen/system-level-design/

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
once a year

Module capacity
unlimited

Module level / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
V+Ü

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
at the end of the lecture period
hands-on exercises and oral exam

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2
SoSe
28

Exercises
2
SoSe
28

Präsenzzeit Modul insgesamt
56 h
inf335 - Strategy Synthesis

Module label: Strategy Synthesis
Modulkürzel: inf335
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction

Zuständige Personen:
 Lehrenden, Die im Modul (Prüfungsberechtigt)
 Lehrenden, Die im Modul (Module responsibility)

Prerequisites

Skills to be acquired in this module:
The students learn fundamental techniques in strategy synthesis as foundation for high-level control strategies in highly autonomous systems.

Professional competences:
The students:
- understand the concepts of open, reactive systems and can explain their relevance
- can provide formal model of open reactive systems and their relevance for system design
- understand the concept of world models as internal representation of a systems environment
- understand and can explain the concept of strategies, and relate this to system design
- understand the relevance of information flow in distributed system
- understand the relevance of choosing the periphery of world models
- can formalize system requirements in temporal logic
- understand the relevance of assumptions in system design

Methodological competences:
The students:
- methods for synthesis of winning strategies in closed systems
- methods for synthesizing remorse-free strategies in open systems
- methods for determining the perimeter of world models
- methods for cooperative strategy synthesis

Social competences:
The students:
- Work in teams
- Solve complex modelling, design, and synthesis tasks in teams

Self-competences:
The students:
- Reflect their actions and respect the scope of methods for strategy synthesis

Module contents:
The module gives an introduction to the synthesis of control strategies for highly autonomous systems. We first introduce classical game theory and present algorithms for synthesizing strategies for reactive system. We extend this to open systems, and analyze conditions, under which synthesis for distributed systems is decidable. We introduce remorse-free strategies and present compositional approaches to synthesis of remorse-free strategies. We analyze under what conditions world models allow for optimal remorse free strategies. We provide algorithms for computing weakest assumptions on the system environments under which winning strategies exist. We extend this to cooperative strategy synthesis, where multiple players cooperate in achieving jointly the system objectives. We illustrate these concepts with examples from autonomous driving.

Literaturempfehlungen:
Suggested reading:
- Bernd Finkbeiner and Leander Tentrup. Detecting unrealizable specifications of distributed systems. In Erika Abraham and Klaus Havelund, editors, Tools and Algorithms for the Construction and Analysis of


Links

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inf336 - Application Area Automotive

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
Lehrenden, Die im Modul (Prüfungsberechtigt)
Köster, Frank (Module responsibility)

**Prerequisites**
This module introduces the application area Automotive.

**Professional competences:**
The students:
- Discuss core-concepts of the transportation domain
- Discuss different modes of transportation (focus on the automotive sector)
- Discuss automated and connected driving (short introduction/overview)
- Discuss human factors in the automotive sector
- Discuss traffic infrastructure (focus on intersections)
- Discuss basic principles in traffic management

**Methodological competences:**
The students:
- Analyze vehicle systems
- Analyze traffic infrastructure
- Analyze cooperative vehicle/infrastructure systems
- Analyze socio-technical systems

**Social competences:**
The students:
- Work in teams
- Discuss their outcomes appropriately

**Self-competences:**
The students:
- Acknowledge the limits of their ability to cope with pressure during the work on the topics of the module

**Module contents**
- Core-concepts of the transportation domain
- Modes of transportation (focus on the automotive sector)
- Automated and connected driving (short introduction/overview)
- Human factors in the automotive sector
- Traffic infrastructure (focus on intersections)
- Basic principles in traffic management

**Literaturempfehlungen**

**Links**

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
once a year

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
V+Ü

**Vorkenntnisse / Previous knowledge**

**Examination**

**Prüfungszeiten**
Type of examination

**Final exam of module**
At the end of the lecture period
Practical Work and oral Exam

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**Präsenzzeit Modul insgesamt**
56 h
inf338 - Design of Autonomous Systems

Module label: Design of Autonomous Systems
Modulkürzel: inf338
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen:
Lehrenden, die im Modul (Prüfungsberichtig)
Fränzl, Martin Georg (Module responsibility)

Prerequisites:
Skills to be acquired in this module
Professional competences:
The students are enabled to analyze and build autonomous systems.

Methodological competences:
The students know examples of existing autonomous systems, understand the elements involved in their architectural design and the rationale behind decomposing the problem into obligations for the respective system components. The module furthermore enables the students to analyze existing architectures for autonomous systems with respect to their performance and safety. The students learn how to decompose a problem of designing an autonomous system into an architecture, are able to derive design obligations for its components, and can structure a pertinent safety case. They understand the software and hardware components necessary for achieving system autonomy and are able to design or instantiate these.

Social competences:
The students acquire hands-on experience in designing components for autonomous systems in small teams and present the underlying theory, their particular design decisions, and their personal evaluation to fellow students.

Self-competences:
The students can judge adequacy of their methodological skills for designing particular autonomous solutions. They are able to assess the safety impact of such a solution and are therefore able to develop a personal ethical stance towards its realization.

Module contents:
The module consists of a lecture and an exercise part.

Literaturrempfehlungen:

Links:
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: once a year
Module capacity: unlimited
Modulelevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: V+Ü

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination:

Final exam of module:
Second half of semester
Presentation

Form of instruction:
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture:
2
WiSe
28

Exercises:
2
WiSe
28

Präsenzzeit Modul insgesamt: 56 h
inf339 - Industrie 4.0 Digitalization in Industrial Manufacturing

Module label: Industrie 4.0 Digitalization in Industrial Manufacturing
Modulkürzel: inf339
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Computing Science (Master) > Technische Informatik

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

Prerequisites:

Skills to be acquired in this module:


Fachkompetenzen:

Die Studierenden:
- erkennen grundlegende Zusammenhänge der Digitalisierung der industriellen Produktion
- erlangen Wissen über Schlüsselkompetenzen im Rahmen der Digitalisierung der industriellen Produktion
- erarbeiten praktisches Wissen über spezielle Themenbereiche in der Digitalisierung der industriellen Produktion
- stellen konkrete Ansätze zur Diskussion

Methodenkompetenzen:

Die Studierenden:
- erfassen benötigte Informationen und analysieren diese
- bereiten die erfassten Informationen zielgruppengerecht auf
- bilden ein Verständnis der Digitalisierung der industriellen Produktion

Sozialkompetenzen:

Die Studierenden:
- präsentieren und diskutieren die eigenen Ausarbeitungen auf fachlicher Ebene

Selbstkompezenten:

Die Studierenden:
- verstehen analysierend ihren eigenen Kenntnisstand
- erlernen das Aufbereiten und Vorstellen einer speziellen Thematik

Module contents:

Das Modul vermittelt grundlegendes Wissen zur Digitalisierung der industriellen Produktion (Industrie 4.0). Neben einem Überblick über wirtschaftliche und technische Aspekte und Möglichkeiten der Digitalisierung der Produktion liegt der Schwerpunkt des Moduls auf Technologien zur Datenerfassung, Kommunikation und Steuerung in Produktionsanlagen.

Vernetzte Werkzeugmaschine, Produktionsplanung und -steuerung, Organisation, Qualität und IT-Systeme für Planung und Betrieb, Gentelligenten Werkstücke, Intelligente Werkzeuge, Transfersysteme, Montage 4.0, Cyber-Security, Wandelbare modulare Automatisierungssysteme, Strategie zur Transformation der Produktion, Geschäftsmodelle
Literaturempfehlungen

„Handbuch Industrie 4.0 – Geschäftsmodelle, Prozesse, Technik“, Gunther Reinhart, 2017

„Handbuch Industrie 4.0 Bd.1 – Produktion“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017

„Handbuch Industrie 4.0 Bd.2 – Automatisierung“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017

„Handbuch Industrie 4.0 Bd.3 – Logistik“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017

„Handbuch Industrie 4.0 Bd.4 – Allgemeine Grundlagen“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
Wintersemester

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
Ergänzung/Professionalisierung

Lehr-/Lernform / Teaching/Learning method
V+S

Vorkenntnisse / Previous knowledge

Final exam of module
Prüfungszeiten
Am Ende der Vorlesungszeiten
Mündliche Prüfung

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2
SoSe oder WiSe
28

Seminar
2
SoSe oder WiSe
28

Präsenzzeit Modul insgesamt
56 h
### Skills to be acquired in this module

**Competencies:**
The students identify fundamentals of uncertainty modeling in control systems as well as problem-specific methods for the consideration of uncertainty during simulation and observer synthesis.

**Professional Competences:**
The students identify fundamentals of uncertainty modeling in control systems, characterize problem-specific solution techniques for systems with stochastic and set-based uncertainty, and are aware of software implementations in simulation, control, and state estimation.

**Methodological Competences:**
The students analyze problems of control-oriented uncertainty modeling, analyze fundamental solution techniques on a theoretical basis as well as transfer and generalize them independently toward novel research-oriented application scenarios.

**Social Competences:**
The students analyze problems of control-oriented uncertainty modeling, analyze fundamental solution techniques on a theoretical basis as well as transfer and generalize them independently toward novel research-oriented application scenarios.

**Self Competences:**
The students critically reflect the achieved results of their project work and acknowledge limitations of various approaches for a control-oriented uncertainty modeling.

### Module contents

1. Mathematical modeling of uncertainty in linear and nonlinear dynamic systems
2. Stochastic modeling approaches
   - Bayesian state estimation for discrete-time systems (linear/nonlinear) and for continuous-time systems (linear)
   - Linear estimation techniques in an extended state-space (Carleman linearization for special system classes)
   - Monte-Carlo methods
3. Estimation of states, parameters and simulation of uncertain processes
   - Outlook: Markov models
   - Outlook: Bayesian networks
4. Set-based approaches
   - Set-based algorithms: Forward-backward contractor and bisection techniques
   - Interval methods for a verified solution of ordinary differential equations and for a stability proof of uncertain systems
   - Estimation of states and parameters as well as simulation of uncertain processes
5. Outlook: Synthesis of controllers and state observers under an explicit description of uncertainty

### Literatureempfehlungen

**Links**

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**Vorkenntnisse / Previous knowledge**  
Grundkenntnisse der Regelung linearer zeitkontinuierlicher und/oder zeitdiskreter Systeme

**Examination**

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**Workload of compulsory attendance**

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**Prüfungszeiten**

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inf341 - Robust Control and State Estimation

Module label: Robust Control and State Estimation

Module code: inf341

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls: Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
Master's Programme Computing Science (Master) > Technische Informatik

Zuständige Personen:
Rauh, Andreas (Module responsibility)

Prerequisites:

Skills to be acquired in this module:

Competencies:
The students identify fundamentals of robust control and state estimation as well as problem-specific solution techniques and their corresponding software implementation.

Professional competences:
The students identify fundamentals of robust control and state estimation, characterize problem-specific solution techniques for different classes of uncertainty and are aware of reliable software implementations.

Methodological competences:
The students analyze problems of robust control and state estimation for dynamic systems, analyze fundamental solution techniques on a theoretical basis, and transfer as well as generalize those independently to new fields of applications.

Social competences:
The students develop solution ideas for real-life control problems within an accompanying project in small teams and explain the obtained results in short presentations.

Self competences:
The students critically reflect the achieved results of their project work and acknowledge limitations of various approaches for robust control and state estimation.

Module contents:

1. Robustness of linear systems/ system analysis
   - Boundary crossing theorem of Frazer and Duncan
   - Mikhailov criterion
   - Kharitonov criterion
   - Frequency response approaches

2. Selected control design techniques/ control synthesis
   - Parameter-space approach of Ackermann and Kaesbauer
   - Eigenvalue and eigenvalue domain assignment
   - H-infinity control
   - Frequency response approaches (Sensitivity function approaches in the frequency domain)

3. Robust LMI-based control techniques
   - Lyapunov stability
   - Polytopic uncertainty modeling
   - Optimality of solutions

4. Duality between control and observer synthesis
   - Robust state estimation
   - Sliding mode observers

5. Interval methods: Solution of static and dynamic problems (Enclosing function values, Branch-and-bound techniques, Verification techniques for differential equations)

6. Fundamentals: Fault detection and fault-tolerant control

Literatureempfehlungen:

4. Rauh, A. Folien/ Skript zur Vorlesung „Robuste Regelung und Zustandsschätzung“.
### Links

**Languages of instruction**: German, English  
**Duration (semesters)**: 1 Semester  
**Module frequency**: Winter term  
**Module capacity**: unlimited  
**Module level / module level**: AS (Akzentsetzung / Accentuation)  
**Moduleart / typ of module**: Wahlpflicht / Elective  
**Lehr-/Lernform / Teaching/Learning method**: V, Ü, P  
**Vorkenntnisse / Previous knowledge**: Grundkenntnisse der Regelung linearer zeitkontinuierlicher und/oder zeidiskreter Systeme  
**Examination**: Prüfungszeiten  
**Form of instruction**: At the end of the lecture period  
**Final exam of module**: Portfolio  

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**Präsenzzeit Modul insgesamt**: 4 h
**Module label** | Special Topics in 'Safety-Critical Systems' I
---|---
**Modulkürzel** | inf350
**Credit points** | 6.0 KP
**Workload** | 180 h
**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Technische Informatik
**Zuständige Personen**
- Lehrende, Die im Modul (Module responsibility)
- Lehrende, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**
The students:
- support team process by their abilities

**Self-competences**
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**
See assigned course description, e.g. „Sicherheitsanalysetechniken“, „Zielarchitekturen Eingebetteter Systeme für Automotive-Anwendungen“, „Modellbasierter Systementwurf“, ...
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inf351 - Special Topics in 'Safety-Critical Systems' II

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**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**

The students:

- support team process by their abilities

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**

See assigned course description, e.g. „Sicherheitsanalysetechniken“, „Modellbasierter Systementwurf“, ...

**Literaturempfehlungen**

As announced in course

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

halbjährlich

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

2 Veranst. aus V, S, Ü, P, PR (4SWS)

**Vorkenntnisse / Previous knowledge**

Examination

Prüfungszeiten

Type of examination

Final exam of module

Portfolio or presentation or oral exam

Form of instruction

VA-Auswahl
<table>
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inf352 - Current Topics in 'Safety-Critical Systems' I

Module contents
See assigned course description

Literatureempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture period
Presentation or oral exam
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inf353 - CurrentTopics in 'Safety-Critical Systems' II

Module label
CurrentTopics in 'Safety-Critical Systems' II

Modulkürzel
inf353

Credit points
3.0 KP

Workload
90 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Technische Informatik

Zuständige Personen
Lehrenden, Die im Modul (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:

- communicate with users and experts convincingly

self-competences
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
S oder V (2SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture period
Presentation or oral exam
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inf354 - Special Topics in ‘Hybrid Systems’ I

Module label Special Topics in ‘Hybrid Systems’ I
Modulkürzel inf354
Credit points 6.0 KP
Workload 180 h
Verwendbarkeit des Moduls Master's Programme Computing Science (Master) > Technische Informatik
Zuständige Personen Fränzle, Martin Georg (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents
See assigned course description, e.g. „Modellbasierter Systementwurf“, „Konstruktionsprinzipien ausgewählter Klassen von Fahrzeugfunktionen“

Literaturempfehlungen
As announced in course

Links

Language of instruction German
Duration (semesters) 1 Semester
Module frequency halbjährlich
Module capacity unlimited
Module level / module level AS (Akzentsetzung / Accentuation)
Modulart / typ of module je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method 2 Veranst. aus V, Ü, S, P, PR (4SWS)

Vorkenntnisse / Previous knowledge

Examination Prüfungszeiten Type of examination
Final exam of module At the end of the lecture period Exercises or presentation or oral exam
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inf355 - Special Topics in 'Hybrid Systems' II

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<td>Workload</td>
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Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Technische Informatik

Zuständige Personen
Fränzle, Martin Georg (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Skills to be acquired in this module
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
2 Veranst. aus V, Ü, S, P, PR (4SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
At the end of the lecture period
Exercises or presentation or oral exam
Form of instruction
VA-Auswahl
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inf356 - CurrentTopics in 'Hybrid Systems' I

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<td>Modulkürzel</td>
<td>inf356</td>
</tr>
<tr>
<td>Credit points</td>
<td>3.0 KP</td>
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<td>Workload</td>
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<td>▪ Master's Programme Computing Science (Master) &gt; Technische Informatik</td>
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<tr>
<td>Zuständige Personen</td>
<td>Fränzle, Martin Georg (Module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
</tr>
</tbody>
</table>

Prerequisites

Skills to be acquired in this module

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**

The students:

- communicate with users and experts convincingly

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

<table>
<thead>
<tr>
<th>Module contents</th>
<th>See assigned course description</th>
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</thead>
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<tr>
<td>Literaturerempfehlungen</td>
<td>As announced in course</td>
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<tr>
<td>Links</td>
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<tr>
<td>Languages of instruction</td>
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<td>S oder V (2SWS)</td>
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<td>Prüfungszeiten</td>
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<td><strong>Course or seminar</strong></td>
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<tr>
<td><strong>Frequency</strong></td>
<td>SoSe oder WiSe</td>
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**inf357 - Current Topics in 'Hybrid System' II**

<table>
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<td>Workload</td>
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<td>Verwendbarkeit des Moduls</td>
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</table>

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:

- communicate with users and experts convincingly

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**

See assigned course description

**Literaturempfehlungen**

As announced in course

**Links**

German

1 Semester

unregelmäßig

unlimited

AS (Akzentsetzung / Accentuation)

je nach Studiengang Pflicht oder Wahlpflicht

S oder V (2SWS)

Prüfungszeiten

Type of examination

At the end of the lecture period

Presentation or oral exam
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</table>
inf358 - Special Topics in 'Hardware/Software Systems' I

**Module label**  
Special Topics in 'Hardware/Software Systems' I

**Modulkürzel**  
inf358

**Credit points**  
6.0 KP

**Workload**  
180 h

**Verwendbarkeit des Moduls**  
- Master's Programme Computing Science (Master) > Technische Informatik

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

**Prerequisites**

**Skills to be acquired in this module**  
This module integrates current developments in the field in adequate study courses.

**Professional competences**  
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**  
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**  
The students:

- support team process by their abilities

**Self-competences**  
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**  
See assigned course description, e.g. „Spezifikation und Modellierung Eingebetteter Systeme“

**Literaturempfehlungen**  
As announced in course

**Links**

**Language of instruction**  
German

**Duration (semesters)**  
1 Semester

**Module frequency**  
halbjährlich

**Module capacity**  
unlimited

**Modullevel / module level**  
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**  
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**  
2 Veranst. aus V, Ü, S, P, PR (4SWS)

**Vorkenntnisse / Previous knowledge**

<table>
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**inf359 - Special Topics in 'Hardware/Software Systems' II**

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<td>Zuständige Personen</td>
<td>Nebel, Wolfgang (Module responsibility)</td>
</tr>
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<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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</table>

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**

The students:

- support team process by their abilities

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**

See assigned course description, e.g. „Spezifikation und Modellierung Eingebetteter Systeme“

**Literaturempfehlungen**

As announced in course

**Links**

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

2 Veranst. aus V, Ü, S, P, PR (4SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**

Prüfungszeiten

Type of examination: Exercices or presentation or oral exam

**Final exam of module**

The exam period will be announced during the course
<table>
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inf360 - CurrentTopics in 'Hardware/Software Systems' I

<table>
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</table>

| Workload   | 90 h                                          |
| Verwendbarkeit des Moduls | Master's Programme Computing Science (Master) > Technische Informatik |
| Zuständige Personen | Nebel, Wolfgang (Module responsibility)  |
| Lehrenden, Die im Modul (Prüfungsberechtigt) | |

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Skills to be acquired in this module**

**Professional competences**

The students:

- Define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- Recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- Examine tasks with technical and research literature, write an academic article and present their solutions academically
- Evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- Schedule time processes and resources

**Social competences**

The students:

- Communicate with users and experts convincingly

**Self-competences**

The students:

- Pursue the overall and special computer science development critically
- Develop and reflect self-developed hypotheses to theories independently

**Module contents**

See assigned course description, e.g. „Energieeffizienz in der IKT“, „Smart Resource Integration“, ...

**Literatureempfehlungen**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

S oder V (2SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**

Prüfungszeiten

**Type of examination**

Presentation or oral exam

**Final exam of module**

At the end of the lecture period
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<td><strong>Frequency</strong></td>
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<td><strong>Workload Präsenzzeit</strong></td>
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inf361 - Current Topics in 'Hardware/Software Systems' II

<table>
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<td>Workload</td>
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<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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</table>

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**

The students:

- communicate with users and experts convincingly

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**

See assigned course description, e.g. „Energieeffizienz in der IKT“, „Smart Resource Integration“, ...

**Literaturempfehlungen**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modulelevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

Examination

Prüfungszeiten

Type of examination

Final exam of module

At the end of the lecture period

As announced in the according course
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<td>SoSe oder WiSe</td>
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<tr>
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</table>
inf366 - Special Topics in 'Microrobotics and Control Engineering' I

Module label: Special Topics in 'Microrobotics and Control Engineering' I
Modulkürzel: inf366
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Technische Informatik

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

Prerequisites:

Skills to be acquired in this module:

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences**
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents:
See assigned course description, e.g. „Nanomontage und Nanohandhabung“

Literaturempfehlungen:
As announced in course

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:
2 Veranst. aus V, S, Ü, P, PR (4SWS)

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten:
Type of examination:
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<td>Portfolio or presentation or oral exam</td>
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<td>Frequency</td>
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<tr>
<td>Workload Präsenzeit</td>
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</table>
inf367 - Special Topics in 'Microrobotics and Control Engineering' II

Module label
Special Topics in 'Microrobotics and Control Engineering' II

Modulkürzel
inf367

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Technische Informatik

Zuständige Personen
Fatikow, Sergej (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:

- support team process by their abilities

Self-competences
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modularität / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
2 Veranst. aus V, Ü, S, P, PR (4SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
The exam period will be announced during the course
Portfolio or presentation or oral exam
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<tr>
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<td>SoSe oder WiSe</td>
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<tr>
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</table>
inf368 - Current Topics in 'Microrobotics and Control Engineering' I

**Module label**
Current Topics in 'Microrobotics and Control Engineering' I

**Modulkürzel**
inf368

**Credit points**
3.0 KP

**Workload**
90 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Technische Informatik

**Zuständige Personen**
Fatikow, Sergej (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:

- communicate with users and experts convincingly

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description

**Literaturnempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten
Type of examination

**Final exam of module**
At the end of the lecture period
Presentation or oral exam
<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Course or seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWS</td>
<td>2</td>
</tr>
<tr>
<td>Frequency</td>
<td>WiSe</td>
</tr>
<tr>
<td>Workload Präsenzzeit</td>
<td>28 h</td>
</tr>
</tbody>
</table>
inf369 - Current Topics in 'Microrobotics and Control Engineering' II

Module label: Current Topics in 'Microrobotics and Control Engineering' II

Modulkürzel: inf369

Credit points: 3.0 KP

Workload: 90 h

Verwendbarkeit des Moduls: Master's Programme Computing Science (Master) > Technische Informatik

Zuständige Personen:
- Fatikow, Sergej (Module responsibility)
- Lehrende, Die im Modul (Prüfungsberechtigt)

Prerequisites:
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:

- communicate with users and experts convincingly

Self-competences
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Module level / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method: S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination: Prüfungszeiten
Type of examination

Final exam of module: At the end of the lecture period
Presentation or oral exam
<table>
<thead>
<tr>
<th><strong>Form of instruction</strong></th>
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<tbody>
<tr>
<td><strong>SWS</strong></td>
<td>2</td>
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<tr>
<td><strong>Frequency</strong></td>
<td>SoSe oder WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzeit</strong></td>
<td>28 h</td>
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</table>
inf374 - Special Topics in 'Automotive' I

<table>
<thead>
<tr>
<th>Module label</th>
<th>Special Topics in 'Automotive' I</th>
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</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>inf374</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Verwendbarkeit des Moduls</td>
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<tr>
<td>Zuständige Personen</td>
<td>Lehrenden, Die im Modul (Module responsibility)</td>
</tr>
<tr>
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<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>This module integrates current developments in the field in adequate study courses.</td>
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</tbody>
</table>

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**

The students:

- support team process by their abilities

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**

See assigned course description, e.g. „Zielarchitekturen Eingebetteter Systeme für Automotive-Anwendungen“

**Literaturempfehlungen**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

halbjährlich

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

2 Veranst. aus V, S, Ü, P, PR (4SWS)

**Vorkenntnisse / Previous knowledge**

Examination Prüfungszeiten Type of examination

Final exam of module Portfolio or presentation or oral exam

**Form of instruction**

VA-Auswahl
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>SWS</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>SoSe oder WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzeit</strong></td>
<td>28 h</td>
</tr>
</tbody>
</table>
inf375 - Special Topics in 'Automotive' II

Module label: Special Topics in 'Automotive' II
Modulkürzel: inf375
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Technische Informatik

Zuständige Personen:
Lehrende, Die im Modul (Module responsibility)
Lehrende, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module:
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- Support team process by their abilities

**Self-competences++

The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method: 2 Veranst. aus V, S, Ü, P, PR (4SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
The exam period will be announced during the course
Portfolio or presentation or oral exam
<table>
<thead>
<tr>
<th><strong>Form of instruction</strong></th>
<th><strong>VA-Auswahl</strong></th>
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<tbody>
<tr>
<td><strong>SWS</strong></td>
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<tr>
<td><strong>Frequency</strong></td>
<td>WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzeit</strong></td>
<td>28 h</td>
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</table>
inf376 - Current Topics in 'Automotive' I

<table>
<thead>
<tr>
<th>Module label</th>
<th>Current Topics in 'Automotive' I</th>
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</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>inf376</td>
</tr>
<tr>
<td>Credit points</td>
<td>3.0 KP</td>
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<td>Workload</td>
<td>90 h</td>
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</table>

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Technische Informatik

**Zuständige Personen**
- Lehrenden, Die im Modul (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Module responsibility)

**Skills to be acquired in this module**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- Define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- Recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- Examine tasks with technical and research literature, write an academic article and present their solutions academically
- Evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- Schedule time processes and resources

**Social competences**
The students:
- Communicate with users and experts convincingly

**Self-competences**
The students:
- Pursue the overall and special computer science development critically
- Develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten

**Type of examination**
Presentation or oral exam

**Final exam of module**
At the end of the lecture period
<table>
<thead>
<tr>
<th><strong>Form of instruction</strong></th>
<th><strong>Course or seminar</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>SWS</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>SoSe oder WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzeit</strong></td>
<td>28 h</td>
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</tbody>
</table>
inf377 - Current Topics in 'Automotive' II

**Module label**  
Current Topics in 'Automotive' II

**Modulkürzel**  
inf377

**Credit points**  
3.0 KP

**Workload**  
90 h

**Verwendbarkeit des Moduls**  
- Master's Programme Computing Science (Master) > Technische Informatik

**Zuständige Personen**  
Lehrenden, Die im Modul (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Skills to be acquired in this module**

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:

- communicate with users and experts convincingly

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**  
See assigned course description

**Literaturempfehlungen**  
As announced in course

**Links**

**Language of instruction**  
German

**Duration (semesters)**  
1 Semester

**Module frequency**  
unregelmäßig

**Module capacity**  
unlimited

**Modullevel / module level**  
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**  
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**  
S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**  
Prüfungszeiten

**Type of examination**

**Final exam of module**  
At the end of the lecture period

**Presentation or oral exam**
<table>
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<tr>
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# inf378 - Special Topics in Technical Computer Science I

<table>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>inf378</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Computing Science (Master) &gt; Technische Informatik</td>
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<td>Zuständige Personen</td>
<td>Lehrenden, Die im Modul (Module responsibility)</td>
</tr>
<tr>
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<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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</table>

**Prerequisites**

Skills to be acquired in this module

**Module contents**

**Literaturempfehlungen**

**Links**

Languages of instruction | German, English
Duration (semesters) | 1 Semester
Module frequency

<table>
<thead>
<tr>
<th>Module capacity</th>
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<tr>
<td>Modullevel / module level</td>
<td>MM (Mastermodul / Master module)</td>
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<td>Modultyp / typ of module</td>
<td>Wahlpflicht / Elective</td>
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</table>

**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

Examination

<table>
<thead>
<tr>
<th>Final exam of module</th>
<th>Klausur oder Portfolio oder Referat oder mündliche Prüfung</th>
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</thead>
<tbody>
<tr>
<td>Examination</td>
<td>Prüfungszeiten</td>
</tr>
<tr>
<td>Form of instruction</td>
<td>VA-Auswahl</td>
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**SWS**

Frequency

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### Special Topics in Technical Computer Science II

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<td>inf379</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
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<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Computing Science (Master) &gt; Technische Informatik</td>
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<tr>
<td>Zuständige Personen</td>
<td>Lehrenden, Die im Modul (Module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
</tr>
</tbody>
</table>

**Prerequisites**

Skills to be acquired in this module

Module contents

Literaturempfehlungen

Links

Languages of Instruction: German, English

Duration (semesters): 1 Semester

Module capacity: unlimited

Module level / module level: MM (Mastermodul / Master module)

Moduleart / typ of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

<table>
<thead>
<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
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<td>Klausur oder Portfolio oder Referat oder mündliche Prüfung</td>
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</table>

Form of instruction: VA-Auswahl

SWS: 4

Frequency: SoSe oder WiSe

Workload Präsenzzeit: 56 h
**inf710 - Special Topics in 'Computer Science Education' I**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Special Topics in 'Computer Science Education' I</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>inf710</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Computing Science (Master) &gt; Technische Informatik</td>
</tr>
</tbody>
</table>
| Zuständigkeits Personen | Diethelm, Ira (Module responsibility)  
Lehrenden, Die im Modul (Prüfungsberechtigt) |

**Skills to be acquired in this module**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**

The students:

- support team process by their abilities

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**

See assigned course description

**Literaturempfehlungen**

As announced in course

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

2 Veranstaltungen aus V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**

<table>
<thead>
<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>Portfolio or presentation or oral exam</td>
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</table>

**Form of instruction**

VA-Auswahl
<table>
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<tr>
<td>Frequency</td>
<td>WiSe</td>
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<tr>
<td>Workload Präsenzzeit</td>
<td>28 h</td>
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</table>
**Angewandte Informatik**

**inf131 - Advanced Topics in Human Computer Interaction**

<table>
<thead>
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<th>Advanced Topics in Human Computer Interaction</th>
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</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
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</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
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</tbody>
</table>

**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Computing Science (Master) > Praktische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction

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

**Prerequisites**

**Skills to be acquired in this module**

This course aims to provide a sample of some of the most recent and significant advances in this exciting area. Topics may include: situational awareness, designing for attention, ambient/peripheral interaction, computer support cooperative work and social computing (CSCW), ubiquitous and context-aware computing, haptic and gestural interaction, audio interaction, gaze-based interaction, biometric interfaces, and embedded, physical and tangible computing, mobile and wearable interfaces.

This course is explicitly not focused on the methods used in HCI practice (i.e., user-centered design cycle), but rather focuses on (recent) research.

**Professional competences:**
The students:
- demonstrate a systematic understanding of knowledge and critical awareness of a selection of the recent research advances in the area of HCI
- evaluate and critique recent developments in the field of HCI on scientific and technological grounds
- develop ability to conceptualize, design, implement, and evaluate user-centered systems and techniques.
- plan and implement exploratory projects directed at envisioning and prototyping novel interactive artifacts

**Methodological competences:**
The students:
- analyze, review and critique research papers
- carry out original research from start to finish
- summarize and present research findings
- work in a team to produce and evaluate prototypes of novel interactive artifact

**Social competences:**
The students:
- work collaboratively in groups to analyze and review research papers
- summarize and present research findings to rest of class
- discuss how HCI concepts and methods can be applied in analysis, design, and evaluation of interactive technologies.
- discuss social and ethical implications of interactive technologies

**Self-competences:**
The students:
- are comfortable tackling original research questions
- show aptitude in conceptualizing and running both qualitative and quantitative HCI experiments
- acquire the ability to summarize, analyze, and critique published (peer-review) research papers

**Module contents**

HCI is a fast-growing field, where scientific research in this area crosses multiple disciplines. The body of theoretical and empirical knowledge that can inform the design of effective systems is rapidly developing, which
underscores the importance of current research in the field.

This course aims to provide a sample of some of the most recent and significant advances in this exciting area. Topics may include: situational awareness, designing for attention, ambient/peripheral interaction, computer support cooperative work and social computing (CSCW), ubiquitous and context-aware computing, haptic and gestural interaction, audio interaction, gaze-based interaction, biometric interfaces, and embedded, physical and tangible computing, mobile and wearable interfaces.

The course will consist of lectures and lab sessions. Lab sessions will cover assignments (writing paper reviews, presentations, and peer assessment). In addition to assignments and a final exam, a small part of the course includes a mini group-based HCI project.

Literaturrempfehlungen


Links

http://www.medien.informatik.uni-oldenburg.de/lehre

Language of instruction

English

Duration (semesters)

1 Semester

Module frequency

semi-annual

Module capacity

24

Reference text

Useful previous knowledge: Interactive Systems

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

Interaktive Systeme

Examination

Prüfungszeiten

Type of examination

Final exam of module

At the end of the lecture period

Missing the exam

If you cannot attend the exam with valid reasons (medical reason, exam schedule conflicts), you need to inform us before the exam, and submit a scanned copy of the evidence (medical certificate, course registration, boarding passes) within 5 days after the exam.

If the reason for missing the exam is valid, you will do your first try of the exam for the parts that you missed on the same date as the second chance exam.

If the reason is not valid, you will not get any score from that exam. If your overall score passed the course, you will not have a chance to take the exam again.

Grading:

Your grade will be calculated as follows:

<table>
<thead>
<tr>
<th>Scored Items</th>
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inf303 - Fuzzy Control and Artificial Neural Networks in Robotics and Automation

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Fatikow, Sergej (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
Experts in different branches try to approach their application-specific control and information processing problems by using fuzzy logic and artificial neural networks (ANN). The experiences gathered up to now prove robotics and automation technology to be predestined fields of application of both these approaches. The major topics of the course are control problems in robotics and automation technology, principles of fuzzy logic and ANN and their practical applications, comparison of conventional and advanced control methods, combination of fuzzy logic and ANN in control systems. The course gives a comprehensive treatment of these advanced approaches for interested students.

**Professional competence**
The students:
- recognise control problems in robotics and automation technology,
- name principles of fuzzy logic and ANN and their practical applications,
- compare conventional and advanced control methods,
- characterise the combination of fuzzy logic and ANN in control systems

**Methodological competence**
The students:
- will acquire knowledge of the tools, methods and applications in fuzzy logic and ANN
- deepen their knowledge for the practical use of the given methods
- can use common software tools for design and application of fuzzy logic and ANN

**Social competence**
The students:
- gain experience in interdisciplinary work
- are integrated into the recent research work

Objective of the module / skills:

**Self-competence**
The students:
- are able to transfer the gained knowledge for later use in their theses or studies for AMiR
- can Design (complex) fuzzy logic controller and ANN systems
- reflect their (control) solutions by using methods learned in this course

**Module contents**
- Control problems in robotics and automation technology
- Basic ideas of fuzzy logic and ANN
- Principles of fuzzy logic
- Fuzzy logic of rule-based systems
- ANN models
- ANN learning rules
- Multilayer perceptron networks and backpropagation
- Associative networks
- Self-organizing feature maps
PID design principles
Design of fuzzy control systems
Fuzzy logic application examples
Design of ANN control systems
ANN application examples
Fuzzy + Neuro: principles and applications

Literatureempfehlungen

Essential:

- Lecture notes (available at the secretariat, A1-3-303) in book form

Recommended:


Secondary Literature:

- Altrock, M. O. R.: Fuzzy Logic, R. Oldenbourg Verlag, 1993
- Kahler, J. und Hubert, F.: Fuzzy-Logik und Fuzzy-Control, Vieweg, 1993
- Kratzer, K.P.: Neuronale Netze, Carl Hanser, 1993
- Lawrence, J.: Neuronale Netze, Systhema Verlag, München, 1992
- Patterson, D.W.: Künstliche neuronale Netze, Prentice Hall, 1996
- Pham, D.T.: Fuzzy Logic: Technologie, Oldenbourg, 1993
- Zakharian, S. Ladewig-Riebler, P. und Thoer, St.: Neuronale Netze für Ingenieure, Vieweg, Wiesbaden, 1998
- Zimmermann H.-J. (Hrsg.): Datenanalyse, VDI-Verlag, 1995

Links

Languages of instruction English, German
Duration (semesters) 1 Semester
Module frequency once a year
Module capacity unlimited
Modullevel / module level AS (Akzentsetzung / Accentuation)
Modulart / typ of module V+Ü
Lehr-/Lernform / Teaching/Learning method Regelungstechnik
Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten Type of examination
Final exam of module At the end of the lecture period until the beginning of the next semester Hands-on-exercises and oral Exam
Form of instruction Comment SWS Frequency Workload of compulsory attendance
Lecture 3 SoSe 42
Exercises 1 SoSe 14
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Fachkompetenzen:

Die Studierenden

- erkennen grundlegende Zusammenhänge der Digitalisierung der industriellen Produktion
- erlangen Wissen über Schlüsselkompetenzen im Rahmen der Digitalisierung der industriellen Produktion
- erarbeiten praktisches Wissen über spezielle Themenbereiche in der Digitalisierung der industriellen Produktion
- stellen konkrete Ansätze zur Diskussion

Methodenkompetenzen:

Die Studierenden

- erfassen benötigte Informationen und analysieren diese
- bereiten die erfassten Informationen zielgruppengerecht auf
- bilden ein Verständnis der Digitalisierung der industriellen Produktion

Sozialkompetenzen:

Die Studierenden

präsentieren und diskutieren die eigenen Ausarbeitungen auf fachlicher Ebene

Selbstkompezenten:

Die Studierenden

- verstehen analysierend ihren eigenen Kenntnisstand
- erlernen das Aufbereiten und Vorstellen einer speziellen Thematik

Module contents

Das Modul vermittelt grundlegendes Wissen zur Digitalisierung der industriellen Produktion (Industrie 4.0). Neben einem Überblick über wirtschaftliche und technische Aspekte und Möglichkeiten der Digitalisierung der Produktion liegt der Schwerpunkt des Moduls auf Technologien zur Datenerfassung, Kommunikation und Steuerung in Produktionsanlagen.

Vernetzte Werkzeugmaschine, Produktionsplanung und -steuerung, Organisation, Qualität und IT-Systeme für Planung und Betrieb, Gentelligente Werkstücke, Intelligente Werkzeuge, Transfersysteme, Montage 4.0, Cyber-Security, Wandelbare modulare Automatisierungssysteme, Strategie zur Transformation der Produktion, Geschäftsmodelle
**Literaturempfehlungen**

- „Handbuch Industrie 4.0 – Geschäftsmodelle, Prozesse, Technik“, Gunther Reinhart, 2017
- „Handbuch Industrie 4.0 Bd.1 – Produktion“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017
- „Handbuch Industrie 4.0 Bd.2 – Automatisierung“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017
- „Handbuch Industrie 4.0 Bd.3 – Logistik“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017
- „Handbuch Industrie 4.0 Bd.4 – Allgemeine Grundlagen“, Birgit Vogel-Heuser, Thomas Bauernhansl, Miachel ten Hompel, 2017

**Links**

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**Vorkenntnisse / Previous knowledge**

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**Form of instruction**

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200 / 373
inf501 - Environmental Information Systems

Module label: Environmental Information Systems

Modulkürzel: inf501

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master Applied Economics and Data Science (Master) > Data Science
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule
- Master's Programme Sustainability Economics and Management (Master) > Additional Modules

Zuständige Personen:
Vogel-Sonnenschein, Ute (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
The module gives an overview of the phases and important aspects of the environmental information processing. **Professional competence** The students: - apply basic processing algorithms to classify and process data - compare, evaluate and design data structures to store spatial data efficiently - apply basic functions of a geo-information system - describe, evaluate and apply basic processes of data mining - describe, evaluate and apply basic geostatistics processes - evaluate and apply multicriteria decision making processes

**Methodological competence** The students: - use geoinformation systems for environmental application - use data mining tools for data analysis **Social competence** The students: - present and discuss their solutions in class **Self-competence** The students: - reflect their own behaviour with regard to the methods of environmental informatics

Module contents:
Content of the Module: Environmental information systems make information about the general environmental state available for public management and public facilities, enterprises or interested citizens. The collection, storage and evaluation of this information is interesting for computer science. Within the scope of the lecture we will examine the processing of environmental information step-by-step, this means: - problems of data acquisition and data processing, - data structures and database concepts for an efficient access to (usually) spatial data, - introduction of data analysis (in particular from geostatistics and data mining), - introduction of multicriteria decision processes, as well as - the supply of data supported by meta data. The module "Umweltinformationssysteme" is accompanied by the module "Modellbildung in Simulation ökologischer Systeme". The subjects of "Modellbildung in Simulation ökologischer Systeme" represent the dynamic aspects of environmental systems (mainly of ecological systems). Nevertheless, the modules can be taken independently from each other.

Literatureempfehlungen:

Links:

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: jährlich

Module capacity: unlimited

Reference text:
Associated with the module: - inf500 Modellbildg. und Sim. ökol. Systeme

Modullevel / module level:

Modulart / typ of module:

Vorkenntnisse / Previous knowledge:
- Datenbanken
- Grundlagen der Statistik/Stochastik

Examination

Prüfungszeiten: Second and third week after the end of the lecture period - retake before the upcoming lecture period

Type of examination: Practical exercises and oral examination or portfolio

Form of instruction

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Präsenzzeit Modul insgesamt: 56 h
**inf502 - Simulation**

**Module label**: Simulation  
**Modulkürzel**: inf502  
**Credit points**: 6.0 KP  
**Workload**: 180 h  

**Verwendbarkeit des Moduls**  
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik  
- Master's Programme Computing Science (Master) > Angewandte Informatik  
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**  
- Hahn, Axel (Module responsibility)  
- Sauer, Jürgen (Module responsibility)  
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
Simulation is a major tool for gaining knowledge about systems and their behavior. It can be used to gain system understanding and prediction future system status. The module covers mathematical basic as well a basic simulation technology. The module completes itself by addressing application examples. By seminar and practical work, the students get hands on experience of simulation technologies.

**Professional competence**  
The students:  
- get an overview on methods, tools and application areas of simulation. They know what simulation can do and what are its limitation. Covered application are mainly in transportation and production domain.

**Methodological competence**  
The students:  
- know simulation technologies and model building basics. They understand the handling of time and problems of discretization. After lecture students can solve problems with simulation. This includes modelling, use of simulation environment and evaluation of results. Cause of practical use, the independent handling of research questions and the use of simulation as research method will be learned.

**Social competence**  
The students:  
- gain team and social skills by self-organized development of simulation.

**Self-competence**  
The students:  
- can apply simulation technologies on scientific research questions.

**Module contents**  
In lectures the students get background information and simulation basics. Then they apply their knowledge by developing an own simulation by using state of the art simulation environments.

**Literaturempfehlungen**

**Links**

**Languages of instruction**: German, English  
**Duration (semesters)**: 1 Semester  
**Module frequency**: annually  
**Module capacity**: unlimited  
**Modullevel / module level**: AS (Akzentsetzung / Accentuation)
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# inf510 - Energy Information Systems

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**Verwendbarkeit des Moduls**
- Master Applied Economics and Data Science (Master) > Specialization
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule

**Zuständige Personen**
Lehnhoff, Sebastian (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
The students will learn different approaches to integrate distributed facilities, the regulatory framework, relevant standards and architecture concepts of energy management systems and will be able to apply this knowledge.

**Professional competence**
The students:
- develop and evaluate IT-architectures for energy management systems
- model objects of this domain appropriately
- model energy information systems
- realise and differentiate advanced tasks of decentralised energy management systems

**Methodological competence**
The students:
- identify problems of energy management, analyse these problems systematically and provide solutions
- apply different simulation approaches of decentralised plants and consumers

**Social competence**
The students:
- discuss solutions for energy management systems in the group
- develop use cases in teams
- present self-developed solutions

**Self-competence**
The students:
- reflect their actions with regard to structuring and decomposing systems
- reflect their own use of power as a limited resource

**Module contents**
This module provides the computer science basics for energy management. It provides the requirements of energy supply information systems with the focus on technical components and the requirements of decentralised and renewable energy plants.

These are:
- Architectures for energy information systems, e.g. SOA, Seamless Integration Architecture (IEC TC 57), OPC-UA
- Norms and standards of energy industry data models (CIM, 61850)
- Systematisation of energy information system requirements based on ontologies
- Development, analysis and adaption of energy industry reference models and processes
- Methods and technologies to support energy industry processes
- Methods and algorithms to support decision processes of the decentralised energy plants control
- Smart Grid plant communication, particularly for load management
- Methods for modelling and simulation of power supply system dynamics

**Literaturempfehlungen**
- Crastan V.: "Elektrische Energieversorgung II", Springer 2004
### Links

- Schwab, A.: "Elektroenergiesysteme, Springer 2009"

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#### Vorkenntnisse / Previous knowledge

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inf511 - Smart Grid Management

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering Physics (Master) > Schwerpunkt: Renewable Energies
- Master's Programme Environmental Modelling (Master) > Mastermodule
- Sustainable Renewable Energy Technologies (Master) > Mastermodule

**Zuständige Personen**
Lehnhoff, Sebastian (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
After successful completion of the course the students should be able to understand the existing structures and technical basis of energy systems to produce, transfer and distribute electricity and their interaction and dependency on each other. They should have developed an understanding for necessary IT- and process control technology components, methods and processes to control and operate electrical energy systems. The students are able to estimate and evaluate the requirements and challenges of ICT and computer science which are caused by the development and integration of unforeseeable fluctuations of decentralised plants. The students will be able to estimate the influence of distributed control concepts and algorithms for decentralised plants and consumers in the so called Smart Grid energy systems. Regarding the requirements the students will be able to analyse the safety, reliability, realtime capability and flexibility of Smart Grid energy systems.

**Professional competence**

The students:
- understand the existing structures and the technical basis of energy systems producing, transferring and distributing electricity and their interaction and dependency on each other.
- develop an understanding for necessary IT- and process control technology components, methods and processes to control and operate electrical energy systems.
- estimate and evaluate the requirements and challenges of ICT and computer science which are caused by the development and integration of unforeseeable fluctuations of decentralised plants.
- estimate the influence of distributed control concepts and algorithms for decentralised plants and consumers in the so called Smart Grid energy systems.

**Methodological competence**

The students:
- analyse the safety, reliability, realtime capability and flexibility of Smart Grid energy systems
- use advanced mathematical methods to calculate networks

**Social competence**

The students:
- create solutions in small teams
- discuss their solutions

**Self-competence**

The students:
- reflect their own use of electricity as a limited resource

**Module contents**

Content of the Module: In this course information technology, economical energy industry and technical basic knowledge and methods are analysed by using concrete Smart Grid approaches. The basic calculation methods for an intelligent grid management are introduced.

This module deals with the technical and economical framework for a permissable electrical network as well as mathematical modelling and calculation methods to analyse conditions of electrical energy networks (in stationary conditions). These are:
The organisation of the EU energy market (regulatory framework, responsibility in liberalisation of electrical energy systems)

- Establishment and operation of electrical energy supply networks (network topology, statutory duties of supply, supply quality/system services, malfunctions and protection systems)

- Intelligent network management (Smart Grids, aggregation forms, machine learning approaches)

Literatureempfehlungen

Suggested reading:

- Crastan V.: "Elektrische Energieversorgung II", Springer 2004

Links

Language of instruction | English
Duration (semesters) | 1 Semester
Module frequency | jährlich
Module capacity | unlimited
Modulelevel / module level | AS (Akzentsetzung / Accentuation)
Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht

Vorkenntnisse / Previous knowledge

Examination | Prüfungszeiten | Type of examination
Final exam of module | At the end of the semester | Oral exam

Form of instruction | Comment | SWS | Frequency | Workload of compulsory attendance
Lecture | 3 | SoSe | 42
Exercises | 1 | SoSe | 14

Präsenzzeit Modul insgesamt | 56 h
**Skills to be acquired in this module**

Successfully completing this lecture will enable the students to mathematically model simple controllable electrical generators and consumers and to simulate them together with appropriate control algorithms within smart grid scenarios. To achieve this goal, students will start with deriving computational models from physical models and evaluate them. In order to manage the integration of control algorithms, students are taught the principles of cosimulation using the “mosaik” smart grid co-simulation framework as an example.

Students will be able to understand and apply distributed, agent-based control schemes to decentralized energy generators and/ or consumers. As a result, students are able to analyze the requirements for successful application to real power balancing regarding capacity utilization, robustness, and flexibility. In addition, students learn the foundations of planning and conducting simulation based experiments as well as the interpretation of the results. Special attention will be paid on establishing a balance between the results’ precision and robustness and the necessary effort (design of experiments) in order to gain as much insight into interdependencies with as few experiments as possible.

**Professional competence**

The students:
- derive and evaluate computational models from physical models
- use the “mosaik” smart grid co-simulation framework
- analyze the requirements for successful applications to real power balancing regarding capacity utilization, robustness, and flexibility
- name the foundations of planning and conducting simulation based experiments as well as the interpretation of the results
- are aware of the balance between the results’ precision and robustness and the necessary effort (design of experiments) in order to gain as much insight into interdependencies with as few experiments.

**Methodological competence**

The students:
- model simple controllable electrical generators and consumers
- simulate simple controllable electrical generators and consumers with appropriate control algorithms within smart grid scenarios
- apply distributed agent-based control schemes to decentralized energy generators and/ or consumers
- evaluate simulation results
- search information and look into methods to implement models
- propose hypothesis and check their validity with design of experiments methods

**Social competence**

The students:
- apply the pair programming development technique
- discuss design decisions
- identify work packages and are responsible for it

**Self-competence**

The students:
- reflect on their own use of power as a limited resource
- accept and use criticism to develop their own behaviour
model controllable, modulating electrical energy generators and consumers,
put their hands on mosaik (installation, description and configuration of scenarios, conduction of simulations),
learn the principles of agent-based heuristics for optimization problems in future smart grid scenarios,
learn about the challenges of implementing agent-based mechanisms (multi-criticality, convergency, quality) on the training,
learn the foundations for choice and design of simulation based experiments.

Suggested reading:

Smart Grids:


Multiagentensysteme:


Co-Simulation


Versuchsplanung:

- Klein, B.: "Versuchsplanung - DoE", Oldenbourg, 2011

Links
http://mosaik.offis.de

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Reference text
Elective module in the master specialization area (energy computer science).
Associated with the modules:
- Energieinformationssysteme
- Smart Grid Management

Module level / module level
AS (Akzentsetzung / Accentuation)

Moduleart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge
- Programmierung mit Java
- Programmierung mit Python

Examination
Prüfungszeiten
Type of examination
Oral exam

Final exam of module
At the end of the semester

Form of instruction
Practical training

SWS
4

Frequency
SoSe

Workload Präsenzzelt
56 h
inf514 - Simulation-based Smart Grid Engineering and Assessment

Module label: Simulation-based Smart Grid Engineering and Assessment
Modulkürzel: inf514
Credit points: 6.0 KP
Workload: 180 h
Verwendbarkeit des Moduls: Master's Programme Computing Science (Master) > Angewandte Informatik
Zuständige Personen: Lehnhoff, Sebastian (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
Das Modul hat zum Ziel in der Energieinformatik benötigte mathematische und methodische Grundlagen zur Durchführung großer Simulationsstudien zu vermitteln.

Fachkompetenzen

Die Studierenden

- kennen Methoden zur Analyse von BlackBox-Zielfunktionen
- erkennen die Zusammenhang zwischen Genauigkeit und Zuverlässigkeit erwarteter Ergebnisse und dem dazu notwendigen Aufwand
- kennen Verfahren, um mit möglichst wenigen Versuchen (Einzelexperimenten) Wirkzusammenhänge zwischen Einflussfaktoren und beobachteten Zielgrößen sicher zu bestimmen
- bewerten die Aussagekraft von durch Simulation erzielten Ergebnissen
- charakterisieren (verteilte) Algorithmen anhand ihrer Eigenschaften
- transferieren Beweistechniken auf verteilte Problemstellungen

Methodenkompetenzen

Die Studierenden

- wählen geeignete statistische Methoden zur Auswertung von Simulationsergebnissen
- wenden Methoden der statistischen Versuchsplanung an
- wenden Signifikanztests an zur Bewertung und zum Vergleich von Algorithmen
- erzeugen beliebig verteilte Daten zur Simulation
- stellen Ergebnisse der Algorithmenbewertung statistisch valide dar

Sozialkompetenzen

Die Studierende

- diskutieren die getroffene Algorithmenauswahl
- präsentieren und diskutieren Ergebnisse mit anderen Studierenden

Selbstkompetenz

Die Studierenden

- reflektieren den eigenen Umgang mit der begrenzten Ressource Energie
- reflektieren Probleme und Unsicherheiten statistischer Methoden
- erkennen die Grenzen simulativer Studien und die Verantwortung bei der richtigen Wahl statistischer Methoden
- nehmen Kritik an und verstehen sie als Vorschlag für die Weiterentwicklung des eigenen Handelns

Module contents

In dieser Veranstaltung werden

- mathematische Grundlagen (Algebra, Statistik, mehrdimensionale Analysis, Regressions- und Korrelationsanalyse) der Energieinformatik vermittelt
- Grundlagen zu Bewertungssystemen (Mötriken, Kriterien) vermittelt
- verschiedene Methoden zur statistischen Auswertung praktisch vermittelt

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### inf515 - Intelligent Energy Systems

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#### Zuständige Personen
- Bremer, Jörg (Module responsibility)
- Lehnhoff, Sebastian (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

#### Prerequisites
- Skills to be acquired in this module

Das Modul befasst sich mit der Integration (verteilter) künstlicher Intelligenz in die zukünftige Steuerung des Energienetzes.

Das Modul vermittelt moderne Techniken der künstlichen Intelligenz und des maschinellen Lernens als Beitrag beispielsweise in der semi-automatischen Betriebsführung von Stromnetzen, bei der von Einsicht getriebenen Vermarktung von dezentralen Energieanlagen oder bei der Prognose von Last- und Erzeugungszeitreihen

#### Fachkompetenzen

Die Studierenden

- kennen Methoden zur Modellierung der Flexibilität von Energieanlagen mittels maschinellem Lernen
- können Flexibilitätmodelle implementieren
- kennen verschiedene Ansätze der Agenten-basierten Modellierung und Koordination im elektrischen Netz
- kennen Techniken des Adversarial Resilience Learning
- bewerten verschiedene Verfahren des Deep und Reinforcement Learning hinsichtlich ihrer Eigenschaften und Eignung in der verteilten Lastplanung
- charakterisieren Methoden maschinellen Lernens anhand ihrer Eigenschaften

#### Methodenkompetenz

Die Studierenden

- erzeugen systematisch zulässige Lösungen mittels Einsatz von Dekodertechnik
- wenden maschinelles Lernen in verteilten Algorithmen praktisch an

#### Sozialkompetenz

Die Studierenden

- wenden die Entwicklungsmethode des Pairprogrammings an
- diskutieren die getroffenen Design Entscheidungen
- präsentieren ihre Arbeitsergebnisse anderen Studierenden

#### Selbstkompetenz

Die Studierenden

- reflektieren den eigenen Umgang mit der begrenzten Ressource Energie
- nehmen Kritik an und verstehen sie als Vorschlag für die Weiterentwicklung des eigenen Handelns
- erkennen die gesellschaftspolitische Verantwortung beim Einsatz von Methoden der künstlichen Intelligenz

#### Module contents

In dieser Veranstaltung werden

- mathematische Grundlagen Supportvektor-basierter Modellierungstechniken vermittelt
- geometrische Untervektorraummodellierungen vermittelt und von den Studierenden angewendet
- Grundlagen verteilter Algorithmen in Energienetzen vermittelt
- das Design intelligenter Agenten mittels Reinforcement Learning und Q-Learning vermittelt und praktisch angewendet
- Grundlagen des Adversarial Resilience Learning vermittelt
Literaturempfehlungen

- Mehr wird in der Veranstaltung bekannt gegeben

Links

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| **Zuständige Personen** | Nieße, Astrid (Module responsibility) 
Lehrenden, Die im Modul (Prüfungsberechtigt) |
| **Prerequisites** | |
| **Skills to be acquired in this module** | |
| **Module contents** | |
| **Literaturempfehlungen** | |
| **Links** | |
| **Languages of instruction** | German, English |
| **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 oder mündliche Prüfung oder Klausur |
| **Form of instruction** | Comment | SWS | Frequency | Workload of compulsory attendance |
| Lecture | 2 | SoSe oder WiSe | 28 |
| Exercises | 2 | SoSe oder WiSe | 28 |
| **Präsenzzeit Modul insgesamt** | 56 h |
inf520 - Management of Information Systems in Health Care

Module label | Management of Information Systems in Health Care
---|---
Modulkürzel | inf520
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen
Marx Gomez, Jorge (Module responsibility)
Fatikow, Sergej (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
Professional competence
The students:

- know healthcare information systems and their functions
- know clinical software architectures and apply their IT strategies
- know and apply system integration standards, methods (including medical technology) and risk management
- know and apply clinical information systems and maintain them
- know the legal and regulatory framework (including data privacy) for the operation of healthcare IT systems
- implement simple data analyses on care data
- know and apply procurement processes and changes

Methodological competence
The students:

Social competence
The students:

- reflect on and become more familiar with the different hospital roles (IT-manager, IT-employer, hospital supervisors, clinician, manager) and their interests

Self-competence
The students:

- reflect their solutions by using methods learned in this course and present them appropriately

Module contents

- Basics of the healthcare system
- Basics of the medical documentation
- Healthcare information systems / clinical information systems / intensive care information systems (PDMS)
- PDMS parameters, including interface terminology and semantic standards
- Data privacy and security
- System integration and interoperability (HL7, …)
- Hospital financing / DRG-System: regulatory framework and implementation
- Care data analyses
- Requirements engineering
- Procurement project and risk management

Literaturempfehlungen
Wird im Modul bekannt gegeben

Links

Language of instruction | German
---|---
Duration (semesters) | 1 Semester
Module frequency | jährlich
Module capacity | unlimited
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| Vorkenntnisse / Previous knowledge | - Medizin für Informatiker  
  - Informationssysteme / Datenbanken |

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| Präsenzzeit Modul insgesamt | 56 h |
inf522 - Information Processing in Bio-Medical Research

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Kaspar, Mathias (Module responsibility)
- Lehrende, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
The students are aware of the requirements of biomedical research information processing and technologies. They know, develop and evaluate approaches.

**Professional competences:**
The students:

- Know the principles of biomedical research and identify resulting requirements and develop appropriate solutions
- Know the regulatory guidelines and assess the suitability of (IT) solutions or develop them
- Plan, apply, evaluate, report and assess IT solution evaluation studies
- Are aware of the biomedical research responsibility and the ethical challenges

**Methodological competences:**
The students:

- Search literature systematically
- Plan and assess clinical studies
- Develop concepts for a data privacy and GCP conform study management
- Know and apply medical classification systems
- Validate and run software for clinical trials, cohorts and registries
- Plan and assess healthcare IT studies

**Social competences:**
The students:

- Present solutions/results
- Discuss studies constructively, professionally and appropriately
- Discuss ethical biomedical research problems from different points of view

**Self-competences:**
The students:

- Reflect their own values and attitudes in the context of medical and biomedical research border areas
- Reflect their self-capacity with regard to the responsibility and the workload during the implementation of studies and the operation of study information systems

**Module contents**

- Basics / Biomedical research theory
- Systematic literature research, repositories
- Study schedule and method design
- Biomedical research regulatory framework
- Biomedical research ethics
- IT infrastructure in research / IT components incl. molecular medicine
- (Data) privacy
- Operating of software for clinical trials, cohorts and registries
- Clinical study report standards (Equator-Network), review process
- Evaluation of healthcare IT (GEP-HI and STARE-HI) / evidence based healthcare informatics

<table>
<thead>
<tr>
<th>Literaturempfehlungen</th>
<th>Wird im Modul bekannt gegeben</th>
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Präsenzzeit Modul insgesamt 56 h
inf523 - Medical Software Engineering

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Zuständige Personen

Kaspar, Mathias (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

This Module provides the regulatory requirements of medical software. Focus is on software life cycle methods and approaches, the implementation of combined usability- and risk management processes as well as quality management.

Professional competence

The students:

- Know and use obligatory medical software requirements
- Know methods and approaches to develop security-critical medical software and implement them by example
- Know at least one medical application area and its specific professional, organisational and regulatory requirements

Methodological competence

The students:

- Are able to apply risk management methods of socio-technical systems
- Are able to extend their knowledge of new application areas. They are able to handle the obstacles of normative frameworks and software development.

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 empathy of other disciplines' working processes are of great importance.

Self-competence

The students:

- Realise their responsibility as a computer scientist and reflect their impact on patients, medical employers and hospitals (corporates)

Module contents

Content of the Module:

This module provides medical software development processes. The module deals with normative software requirements with the focus on patient privacy and quality management. Contents are the declaration of conformity based on medical product classes and software security classes. The software security is focused on software quality, tests and verification, validation as well as quality and risk management. The software life cycle provides security related systems and software as well as software architecture and different process models.

Literaturempfehlungen

wird im Modul bekannt gegeben

Links

Languages of Instruction

German, English

Duration (semesters)

1 Semester

Module frequency

once a year

Module capacity

unlimited
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Präsenzzzeit Modul insgesamt 56 h
### inf524 - Introduction to Medicine for Computer Science Students

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| Verwendbarkeit des Moduls                   | • Master's Programme Computing Science (Master) > Angewandte Informatik  
• Master's Programme Computing Science (Master) > Nicht Informatik |
| Zuständige Personen                         | Kaspar, Mathias (Module responsibility)                |
|                                            | Lehrenden, Die im Modul (Prüfungsberechtigt)           |

#### Prerequisites

**Skills to be acquired in this module**


**Module contents**


#### Literaturempfehlungen

- Speckmann / Wittkowski, Handbuch Anatomie, h.f. ullmann publishing GmbH 2015, ISBN 978-3-8480-0878-0

#### Links

https://www.uni-oldenburg.de/versorgungsforschung/abteilungen/medizininformatik/lehre/

#### Language of instruction

German

#### Duration (semesters)

1 Semester

#### Module frequency

jährlich

#### Module capacity

unlimited

#### Reference text

Die Durchführung der Veranstaltung erfolgt in Kooperation mit verschiedenen Professuren der Departments. Für Humanmedizin, sowie der Anatomie der Fakultät VI.

#### Modullevel / module level

AS (Akzentsetzung / Accentuation)

#### Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge

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# Probabilistic Modelling I

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Fatikow, Sergej (Module responsibility)
- Marx Gomez, Jorge (Module responsibility)
- Boll-Westermann, Susanne (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**
Probabilistic Bayesian models are generated with special tools (e.g. BUGS, JAGS, STAN) or domain specific programming languages (WebPPL, PyMC3, …etc.). If they mimic cognitive processes of humans (e.g. pilots, drivers) or animals they could be used as cooperative assistance systems in technical or financial systems like cars, robots, or recommenders.

**Professional competence**
The students:
- learn to map problem to model classes to come up with practical solutions

**Methodological competence**
The students:
- acquire basic skills in the design, implementation, and identification of probabilistic models with Bayesian methods
- acquire knowledge about alternative non-Bayesian machine learning methods

**Social competence**
The students:
- learn to present and discuss probabilistic theories, methods, and models.

**Self-competence**
The students:
- reflect and evaluate chances and limitations of probabilistic approaches
- learn to deliberate on machine-learning alternatives

**Module contents**
Theories, methods, and examples of Bayesian models with practical applications

**Literaturempfehlungen**
Recent eBooks, eTutorials

**Links**
http://www.uni-oldenburg.de/en/computingscience/ics/probabilistic-programming/

**Languages of instruction**
German, English

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Reference text**
Associated with the module:

- inf534 Probabilistic Modelling II

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)
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### Probabilistic Modelling II

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction

**Zuständige Personen**
- Boll-Westermann, Susanne (Module responsibility)
- Marx Gomez, Jorge (Module responsibility)
- Fatikow, Sergej (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

- Probabilistic models are generated with special tools (e.g. BUGS, JAGS, STAN) or domain specific programming languages (WebPPL, PyMC3, …, etc.). If they mimic cognitive processes of humans (e.g. pilots, drivers) or animals they could be used as cooperative assistance systems in technical or financial systems like cars, robots, or recommenders. In this part of the seminar we read, present, and discuss recent research papers.

**Professional competence:**
- The students:
  - learn to connect problem- with model classes to come up with practical solutions

**Methodological competence**
- The students:
  - acquire advanced skills in the design, implementation, and identification of probabilistic models with Bayesian methods
  - acquire knowledge about alternative machine learning methods

**Social competence**
- The students:
  - learn to present and discuss probabilistic theories, methods, and models

**Self-competence**
- The students:
  - reflect and evaluate chances and limitations of probabilistic approaches
  - learn to deliberate on machine-learning alternatives

**Module contents**
- Theories, methods, and examples of Bayesian models with practical applications

**Literaturempfehlungen**
- Recent publications

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- halbjährlich

**Module capacity**
- unlimited

**Reference text**
- Associated with the module:
  - inf533 Probabilistische Modellierung I

**Modulelevel / module level**
- AS (Akzentsetzung / Accentuation)
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### inf535 - Computational Intelligence I

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**Verwendbarkeit des Moduls**
- Master Applied Economics and Data Science (Master) > Data Science
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Environmental Modelling (Master) > Mastermodule

**Zuständige Personen**

Kramer, Oliver (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

**Professional competence:**

The students:

- recognise optimisation problems
- implement simple algorithms of heuristic optimisation
- critically discuss solutions and selection of methods
- deepen previous knowledge of analysis and linear algebra

**Methodological competence**

The students:

- deepen programming skills
- apply modelling skills
- learn about the relation between problem class and method selection

**Social competence**

The students:

- cooperatively implement content introduced in lecture
- evaluate own solutions and compare them with those of their peers

**Self-competence**

The students:

- evaluate own skills with reference to peers
- realize personal limitations
- adapt own problem solving approaches with reference to required method competences

**Module contents**

Computational Intelligence comprises intelligent and adaptive methods for optimisation and learning. The module “Computational Intelligence I” concentrates on methods for evolutionary optimisation and heuristic approaches. The exercises introduce and deepen practical aspects of the implementation and algorithmic design, also taking into account application aspects.

**Overview of Content:**

- foundations of optimisation
- genetic algorithms and evolution strategies
- parameter control and self-adaptation
- runtime analysis
- swarm algorithms
- constrained optimisation
- multi-objective optimisation
- meta-modeling

**Literaturempfehlungen**

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| Präsenzzeit Modul insgesamt | 56 h |
inf536 - Computational Intelligence II

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**Verwendbarkeit des Moduls**
- Master Applied Economics and Data Science (Master) > Data Science
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Environmental Modelling (Master) > Mastermodule

**Zuständige Personen**
Kramer, Oliver (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

In the lecture "Convolutional Neural Networks" you will learn the basics of Convolutional Neural Networks, from methodological understanding to implementation.

**Professional competence**
Students will learn Deep Learning expertise, which are essential qualifications as AI experts and Data Scientists.

**Methodological competence**
Students learn the methods mentioned as well as the implementation in Python, NymPy and Keras.

**Social competence**
Students are encouraged to discuss the taught content in groups and work together to implement the programming tasks in the exercises.

**Self-competence**
Students are guided to conduct independent research on advanced methods as the teaching field changes dynamically.

**Module contents**
Students learn the basics of machine learning and in particular the topics of dense layers, cross-entropy, backpropagation, SGD, momentum, Adam, batch normalization, regularisation, convolution, pooling, ResNet, DenseNet, and convolutional SOMs.

**Literaturempfehlungen**
Deep Learning by Aaron C. Courville, Ian Goodfellow and Yoshua Bengio

**Links**
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: once a year
- Module capacity: unlimited
- Modulniveau / 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: - inf535 Computational Intelligence I
                                - Statistik
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| Präsenzzeit Modul insgesamt | 56 h |
**inf537 - Intelligent Systems**

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**Verwendbarkeit des Moduls**
- Master’s Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master’s Programme Computing Science (Master) > Angewandte Informatik
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Sauer, Jürgen (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
- **Professional competence** The students: - name the structure of agent-based systems - use problem-solving methods for complex problems - characterise the application area of process planning - evaluate the suitability of processes regarding to specific problems
- **Methodological competence** The students: - assign problem-solving methods to different problems
- **Social competence** The students: - implement selected methods in small teams
- **Self-competence** The students: - develop own solutions for given problems

**Module contents**
A lot of application areas use "intelligent" problem-solving methods. These are the main focus of this lecture. They will be illustrated by examples in order to enhance the students' problem-solving abilities. These include:
- A brief introduction into AI
- Solution methods of AI like heuristics, meta-heuristics, soft computing methods
- To apply and foster the contents of the lecture, an intelligent planning system is implemented in practical exercises.

**Literaturempfehlungen**
- Ghallab/ Nau/Traverso: Automated Planning, Morgan Kaufman, 2004

**Links**
- www.wi-ol.de

**Languages of instruction**
- German, English

**Duration (semesters)**
- 1 Semester

**Module frequency**
- once a year

**Module capacity**
- unlimited

**Reference text**
- Dieses Modul ist im Rahmen der Projekte FiIF und FoL konzipiert worden

**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**
- Produktionsorientierte Wirtschaftsinformatik

**Examination**
- Prüfungszeiten

**Final exam of module**
- At the end of the lecture period
- Practical exercises and oral exam or practical exercises and written exam or portfolio

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**Präsenzzeit Modul insgesamt**
- 56 h
**inf538 - Management of IT-Services**

**Module label**  
Management of IT-Services

**Modulkürzel**  
inf538

**Credit points**  
6.0 KP

**Workload**  
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

**Zuständige Personen**
- Sauer, Jürgen (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

**Professional competence** The students: - characterise problems that occur during the operation of large-
scale operating systems - characterise conceptional, technical, economical and organizational problem-solving
processes - use these concepts to solve problems validly

**Methodological competence** The students: - describe a current problem area based on information from the internet and literature

**Social competence** The students: - present their findings on a problem area - discuss their results regarding a specific application
area

**Self-competence** The students: - reflect actual concepts with regard to specific application areas

**Module contents**

**Content of the Module:** "Adaptive Computing" deals with the field of concepts and solutions to manage large
scale application systems or dynamic data centers. Technically oriented solutions like the configuration of data
centers such as the hard- and software virtualization, the high availability, the storage management and the
identity management are not the only contributions of Adaptive Computing. Others are organisational aspects
of companies, such as personnel planning and service agreements. This module provides and compiles current
topics of Adaptive Computing. The module also presents and evaluates several Adaptable Computing
technologies. Current HW-/ SW-concepts of large-scale application systems, strategies, service management
and security concepts are specifically included. The lecture introduces current concepts and solutions for the
management of dynamic data centers. Among others, the following subjects are provided: - IT-Strategy,
- Organisation - ITIL (overview) - Service-Management Tools (e.g. OTRS) - Outsourcing - Security (policies,
privacy, data security, safety) - Spatial design of data centers - HW-Strategies: Cluster, Storage, ... - Virtualization - IdM - Portals - Configuration management - Accounting, performance calculation and evaluation,

**Literaturempfehlungen**

**Suggested reading:**
- current company data - current materials from internet

- Böttcher, Roland: IT-Servicemanagement mit ITIL V3 : Einführung, Zusammenfassung und Übersicht der elementaren
- Tiemeyer, Ernst: Handbuch IT-Management: Konzepte, Methoden, Lösungen und Arbeitshilfen für die Praxis, Hanser, 2006

**Links**

**Language of instruction**  
German

**Duration (semesters)**  
1 Semester

**Module frequency**  
jährlich

**Module capacity**  
unlimited

**Module level / module level**  
AS (Akzentsetzung / Accentuation)

**Modulart / type of module**  
je nach Studiengang Pflicht oder Wahlpflicht

**Vorkenntnisse / Previous knowledge**

**Examination**  
Prüfungszeiten - Type of examination

**Final exam of module**  
at the end of the semester - Portfolio

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**Präsenzzeit Modul insgesamt**  
56 h
### inf541 - Data Challenge

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodulle der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

**Zuständige Personen**
- Marx Gomez, Jorge (Module responsibility)
- Lehrenden, Die im Modul (Module responsibility)

**Prerequisites**

**Skills to be acquired in this module**


**Fachkompetenzen**
- Die Studierenden: erlernen den Umgang mit strukturierten und unstrukturierten Datenquellen.
- erarbeiten praktisches Wissen über verschiedene Methoden der Data Science.
- erlernen grundlegende Vorgehensweisen in der Durchführung von Data Science-Projekten.
- verfolgen und verfeinern die Umsetzung des praxisnahen Lernens durch ein z.T. vorgegebenes, aber auch durch Eigeninitiative ausgestaltetes Modellszenario.

**Methodenkompetenzen**
Die Studierenden:
- sind in der Lage Datensätze zu explorieren und zu analysieren
- erkennen Zusammenhänge in großen Datensätzen
- bilden ein Hypothesen zur Lösung einer unternehmerischen Problemstellung.

**Sozialkompetenzen**
Die Studierenden:
- arbeiten in Gruppen und müssen so Arbeitspakete identifizieren und Verantwortlichkeiten wahren.
- präsentieren und diskutieren die eigenen (Teil-) Ergebnisse auf fachlicher Ebene

**Selbstkompetenzen**
Die Studierenden:
- reflektieren ihr Vorgehen anhand von selbst gesteckten Zielen.
- erfassen benötigte Informationen und analysieren diese.
- bereiten die erfassten Informationen zielgruppengerecht auf.

**Module contents**
Soll die Methodenkompetenz im Bereich Data Science erlernt und ausgebaut werden, dann geht dies meist nur mithilfe von frei verfügbaren, idealisierten Datensätzen und beispielhaften Aufgabenstellungen. Grundsätzliche Programmierkenntnisse können so erlangt werden, der Umgang mit echten unternehmerischen Problem und deren Lösung mithilfe von Data Science-Verfahren kann allerdings nur durch die Übung in der Praxis erlernt. Im Rahmen dieses Moduls wird eine reale Problemstellung eines Praxispartners vorgestellt, dieser Partner stellt Daten und Domänenwissen bereit und im Anschluss muss selbstständig eine datenzentrierte Lösung für dieses Problem entworfen und umgesetzt werden.

Innerhalb des Moduls werden darauf aufbauend folgende Themenkomplexe behandelt:
- Exploration und Analyse von Daten
- Methoden der Data Science (z.B. Deep Learning)
- Umgang mit Programmiersprachen und Entwicklungsframeworks (R, Python, Tensorflow)
- Hypothesenbildung und Data Storytelling
Literaturempfehlungen


**Links**

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

<table>
<thead>
<tr>
<th><strong>Language of instruction</strong></th>
<th>German</th>
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<td><strong>Modulart / typ of module</strong></td>
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<td>PR Blockseminar</td>
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<td><strong>Frequency</strong></td>
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## inf551 - Maritime Systems

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<td>Modulkürzel</td>
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<td>6.0 KP</td>
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### Prerequisites

**Skills to be acquired in this module**
The module deals with the economic aspects and synergy effects of maritime sub-areas. In addition to the basic knowledge of the maritime sub-areas, current approaches from research are taught. The basic ship parameters are examined with regard to their economic efficiency, stability calculations and ship dynamics are derived and effects of the ship hull, propellers and systems on the economic efficiency of a ship are considered. The focus here is on understanding economic thinking and the interaction of the sub-areas. Furthermore, future-oriented solutions and trends will be discussed. **Professional competence** The students - name the basics of planning and control of operational logistics in a shipyard - name the basics of planning of economic design - recognise the application possibilities of simulation in design, construction and dynamics - identify the basic maritime sub-areas and their synergies **Methodological competence** The students - Link relations with tree structures - Illustrate the questions and concepts of the design process **Social competence** The students - Present computational problem solving to groups - Discuss their outcomes appropriately - Implement solutions of given problems in teams - Accept criticism of their peer group as valuable contributions **Self-competence** The students - reflect their self-image and their actions of their results

### Module contents


### Literature recommendations


### Links

http://www.wi-ol.de

### Languages of instruction

German, English

### Duration (semesters)

1 Semester

### Module frequency

annually in winterterm

### Module capacity

unlimited

### Modulart / type of module

Wahlmodul / Opportunity

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

V+Ü

### Vorkenntnisse / Previous knowledge

Transportsysteme, Analysis, Differentialgleichungen, lineare Algebra, Mechanik

### Examination

Prüfungszeiten | Type of examination
--- | ---
| Final exam of module | at the end of the lecture period | practical exercises and oral examination

### Form of instruction

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### Präsenzzeit Modul insgesamt

56 h
inf581 - Special Topics in 'Digitalized Energy Systems'

Module label: Special Topics in 'Digitalized Energy Systems'

Modulkürzel: inf581

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
- der Informatik, Lehrende (Prüfungsberechtigt)
- Nieße, Astrid (Module responsibility)
- Vogel-Sonnenschein, Ute (Module responsibility)

Prerequisites:

Skills to be acquired in this module:
The aim of the module is to integrate current developments in the field of digitized energy systems into the course in the appropriate course forms. Specialist skills: The students:
- differentiate and contrast a sub-area of computer science in which they have specialized in more detail or reflect on computer science in general
- recognize and assess the techniques and methods to be used in their special field and their limits

Module contents:
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Literaturempfehlungen:
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Links:

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

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

Modulart / typ of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method: 2 Veranstaltungen aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge:

Examination:
- Prüfungszeiten
- Type of examination
- Final exam of module: Am Ende der Vorlesungszeit nach Absprache mit dem Lehrenden
- Portfolio-Prüfung

Form of instruction:

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Präsenzzeit Modul insgesamt: 56 h
inf584 - Special Topics in 'Energy Informatics' I

Module label: Special Topics in 'Energy Informatics' I

Modulekürzel: inf584

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
- Lehnhoff, Sebastian (Prüfungsberechtigt)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module:

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents:
See assigned course description

Literaturempfehlungen:
As announced in course

Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modulelevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:
2 Veranst. aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge

Examination / Prüfungszeiten / Type of examination
Final exam of module:
At the end of the lecture period
Portfolio or presentation or oral exam

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inf585 - Special Topics in 'Energy Informatics' II

**Module label**  
Special Topics in 'Energy Informatics' II

**Modulkürzel**  
inf585

**Credit points**  
6.0 KP

**Workload**  
180 h

**Verwendbarkeit des Moduls**  
- Master's Programme Computing Science (Master) > Angewandte Informatik

**Zuständige Personen**  
Lehrenden, Die im Modul (Prüfungsberechtigt)
Lehnhoff, Sebastian (Module responsibility)

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**
The students:

- support team process by their abilities

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
ge nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
2 Veranst. aus V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten

**Final exam of module**
At the end of the lecture period

**Form of instruction**
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inf586 - Current Topics in 'Energy Informatics' I

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</table>

Prerequisites

Skills to be acquired in this module
This module integrates current developments in the field in adequate study courses.

Professional competences

The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences

The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences

The students:
- communicate with users and experts convincingly

Self-competences

The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literature empfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Module level/module level
AS (Akzentsetzung/Accentuation)

Modulart/typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform/Teaching/Learning method
S oder V (2 SWS)

Vorkenntnisse/Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture period
Presentation or oral exam
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inf587 - Current Topics in 'Energy Informatics' II

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Angewandte Informatik

**Zuständige Personen**
Lehnhoff, Sebastian (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:
- communicate with users and experts convincingly

**Self-competences**
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel / module level**
AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten
Type of examination
Final exam of module
At the end of the lecture period
Presentation or oral exam
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**inf588 - Special Topics in 'Medical Informatics' I**

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**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences**

The students:

- support team process by their abilities

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

**Module contents**

See assigned course description, e.g. „Medizinische Bildverarbeitung“ or „Standard und Systeme für die Kommunikation in der Medizin“

**Literaturempfehlungen**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

2 Veranst. aus V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**

**Examination**

Prüfungszeiten

Type of examination

**Final exam of module**

At the end of the lecture period

Portfolio or presentation or oral exam
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<td>28 h</td>
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</table>
### Module Contents

This module integrates current developments in the field in adequate study courses.

#### Professional Competences

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 Competences

The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 Competences

The students:

- support team process by their abilities

#### Self-Competences

The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

### Literature Recommendations

As announced in the according course

### Links

German

### Duration (Semesters)

1 Semester

### Module Frequency

unregelmäßig

### Module Level / Module Level

AS (Akzentsetzung / Accentuation)

### Modulart / Type of Module

je nach Studiengang Pflicht oder Wahlpflicht

### Lehr-/Lernform / Teaching/Learning Method

2 Veranst. aus V, S, Ü, P, PR

### Examination

At the end of the lecture period

### Type of Examination

Portfolio or presentation or oral exam
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<td>Workload Präsenzzzeit</td>
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inf590 - Current Topics in 'Medical Informatics' I

Module label
Current Topics in 'Medical Informatics' I

Modulkürzel
inf590

Credit points
3.0 KP

Workload
90 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen
Hein, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:
- communicate with users and experts convincingly

Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturnempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture period
Presentation or oral exam
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# inf591 - Current Topics in 'Digitalized Energy systems'

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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
<td>90 h</td>
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<td>Zuständige Personen</td>
<td>Hein, Andreas (Module responsibility)</td>
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</tbody>
</table>

## Prerequisites

This module integrates current developments in the field in adequate study courses.

### Professional competences

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

### Social competences

The students:

- communicate with users and experts convincingly

### Self-competences

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

## Module contents

See assigned course description

## Literatureempfehlungen

As announced in course

## Links

Language of instruction  German

Duration (semesters)  1 Semester

Module frequency  unregelmäßig

Module capacity  unlimited

Module level / module level  AS (Akzentsetzung / Accentuation)

Modularität / typ of module  je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method  S oder V (2 SWS)

## Vorkenntnisse / Previous knowledge

Examination  Prüfungszeiten

Final exam of module  At the end of the lecture period  Presentation or oral exam
<table>
<thead>
<tr>
<th>Form of instruction</th>
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<tr>
<td>Frequency</td>
<td>WiSe</td>
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<tr>
<td>Workload Präsenzzzeit</td>
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inf594 - Current Topics in 'Learning and Cognitive Systems' I

Module label: Current Topics in 'Learning and Cognitive Systems' I
Modulkürzel: inf594
Credit points: 3.0 KP
Workload: 90 h

Verwendbarkeit des Moduls: Master's Programme Computing Science (Master) > Angewandte Informatik
Zuständige Personen: Fatikow, Sergej (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module: This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:
- communicate with users and experts convincingly

Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents: See assigned course description, e.g. „Kognitive Modellierung“, „KI und Wissensrepräsentation“

Literaturempfehlungen: As announced in course

Links

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

Modulelevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method: S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination: Prüfungszeiten
Type of examination: Presentation or oral exam
Final exam of module: At the end of the lecture period
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### inf595 - Current Topics in 'Learning and Cognitive Systems' II

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<td>inf595</td>
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<td>Workload</td>
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<td>Fatikow, Sergej (Module responsibility)</td>
</tr>
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</table>

#### Prerequisites

This module integrates current developments in the field in adequate study courses.

**Professional competences**

- Define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- Recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

- Examine tasks with technical and research literature, write an academic article and present their solutions academically
- Evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- Schedule time processes and resources

**Social competences**

- Communicate with users and experts convincingly

**Self-competences**

- Pursue the overall and special computer science development critically
- Develop and reflect self-developed hypotheses to theories independently

#### Module contents

See assigned course description

#### Literatureempfehlungen

As announced in course

#### Links

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modulelevel / module level: AS (Akzentsetzung / Accentuation)
- Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
- Lehr-/Lernform / Teaching/Learning method: S oder V (2 SWS)

#### Examination / Previous knowledge

Examination: Prüfungszeiten
Type of examination: Presentation or oral exam

Final exam of module: At the end of the lecture period
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<thead>
<tr>
<th>Form of instruction</th>
<th>Course or seminar</th>
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<tbody>
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<td>Frequency</td>
<td>WiSe</td>
</tr>
<tr>
<td>Workload Präsenzzeit</td>
<td>28 h</td>
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</tbody>
</table>
inf596 - Special Topics in "Computational Intelligence" I

Module label: Special Topics in "Computational Intelligence" I

Modulekürzel: inf596

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
- Kramer, Oliver (Module responsibility)
- Lehrende, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:

Professional competences:
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences:
The students:

- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences:
The students:

- support team process by their abilities

Self-competences:
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents:

See assigned course description, e.g. „Medizinische Bildverarbeitung“ or „Standard und Systeme für die Kommunikation in der Medizin“

Literaturempfehlungen:

As announced in the according course

Links:

Language of instruction: German

Duration (semesters):
1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modullevel / module level:
AS (Akzentsetzung / Accentuation)

Modulart / typ of module:
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:
2 Veranst. aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination

Final exam of module:
At the end of the lecture period
Portfolio or presentation or oral exam
<table>
<thead>
<tr>
<th><strong>Form of instruction</strong></th>
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<td><strong>Frequency</strong></td>
<td>WiSe</td>
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<td><strong>Workload Präsenzzeit</strong></td>
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</table>
inf597 - Special Topics in "Computational Intelligence" II

Module label: Special Topics in "Computational Intelligence" II
Modulkürzel: inf597
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
Kramer, Oliver (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
This module integrates current developments in the field in adequate study courses.

Professional competences:
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences:
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences:
The students:
- support team process by their abilities

Self-competences:
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents:
See assigned course description

Literaturempfehlungen:
As announced in course

Links:

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

Modullevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module:
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:
2 Veranst. aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination
Final exam of module:
At the end of the lecture period
Portfolio or presentation or oral exam

Form of instruction:
VA-Auswahl
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<td>Workload Präsenzzeit</td>
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</table>
inf598 - Current Topics in 'Computational Intelligence' I

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<thead>
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<td>Modulkürzel</td>
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</table>

**Prerequisites**

This module integrates current developments in the field in adequate study courses.

**Professional competences**

The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**

The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**

The students:

- communicate with users and experts convincingly

**Self-competences**

The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**

See assigned course description

**Literaturempfehlungen**

As announced in course

**Links**

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modulelevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method: S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

Examination: Prüfungszeiten

Type of examination: Presentation or oral exam

**Final exam of module**

At the end of the lecture period
<table>
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inf599 - Current Topics in 'Computational Intelligence' II

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<td>Kramer, Oliver (Module responsibility)</td>
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**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:

- communicate with users and experts convincingly

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description, e.g. „Kognitive Modellierung“, „KI und Wissensrepräsentation“

**Literaturempfehlungen**
As announced in course

**Links**

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**Vorkenntnisse / Previous knowledge**

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<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>Presentation or oral exam</td>
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<td>Course or seminar</td>
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inf604 - Business Intelligence I

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<td>Workload</td>
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Verwendbarkeit des Moduls
- Master Applied Economics and Data Science (Master) > Data Science
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen
Marx Gomez, Jorge (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module
Objective of the module/skills:
Current module provides basics of business intelligence with focus on enterprises and strong emphasis on data warehousing technologies. Students of the course are provided with knowledge, which reflects current research and development in a data analytic domain.

Professional competence
The students:
- name and recognize the role of business intelligence as part of daily business process
- being able to analyse advantages and disadvantages of different approaches and methods of the data analytics and being able to apply them in simple case studies
- obtain theoretical knowledge about data collection and modelling processes, including most applicable approaches and best practices

Methodological competence
The students:
- being able to execute typical tasks of business intelligence, and also being able to deepen knowledge on different approaches and methods
- gain a hands on experience and being able to understand advantages and disadvantages of different methods and being able to use obtained knowledge in most efficient ways

Social competence
The students:
- build solutions based on case studies given to the group, for example solving the issue of a factless fact table
- discuss solutions on a technical level
- present obtained case studies solutions as part of the exercises

Self-competence
The students:
- critically review provided data and information

Module contents
Data warehouse technology together with business intelligence are increasingly being used by business in order to get better decision support and enrich ongoing processes with data-rich decisions. Data warehouse technology enables an integration of data from heterogeneous sources, whether business intelligence builds data processing on top of it. For instance, business intelligence allows to build reporting on very large volumes of data (including historical) coming primary from data warehouse.

As part of the current module following contents are taught:
- Definition and scope of business intelligence.
- Procedures and objectives of data warehousing.
- Process of extracting, transforming and loading (ETL) of data.
- Phases of data modelling, data capturing and reporting in conjunction with a plausible case studies/scenarios.
- Prospects for further and evolving topics for business intelligence (e.g. Adaptive Business Intelligence, In-MemoryComputing, etc.)
- Introduction to Data Mining.
- Case studies based practical exercises and assessments in order to impart practical knowledge.

**Literaturempfehlungen**

- Marx Gómez, Rautenstrauch, Cissek (2008): Einführung in die Business Intelligence mit SAP NetWeaver 7.0.

**Links**

http://www.wi-ol.de

**Languages of instruction**

German, English

**Duration (semesters)**

1 Semester

**Module frequency**

jährlich

**Module capacity**

unlimited

**Modullevel / module level**

AS (Akzentsetzung / Accentuation)

**Modulart / typ of module**

Wahlpflicht / Elective

**Lehr-/Lernform / Teaching/Learning method**

V + Ü

**Vorkenntnisse / Previous knowledge**

**Exam**

Prüfungszeiten

Type of examination

**Final exam of module**

At the end of the lecture period

Written exam max. 120 minutes

**Form of instruction**

Comment

SWS

Frequency

Workload of compulsory attendance

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<tbody>
<tr>
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<td>28</td>
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</table>

**Präsenzzeit Modul insgesamt**

56 h
inf607 - Business Intelligence II

Module label | Business Intelligence II
Modulkürzel | inf607
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls
- Master Applied Economics and Data Science (Master) > Data Science
- Master's Programme Business Informatics (Master) > Akzentsetzungsmoduls der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen
Marx Gomez, Jorge (Prüfungsberechtigt)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module
Current module provides advanced business intelligence, data science with focus on enterprises and strong emphasis on big data and data analytics. Students of the course are provided with knowledge, which reflects current research and development in a data analytics domain.

Professional competence
The students:
- name and recognize the role of data analytics / data science as part of a daily business process in a particular company
- able to organize from management perspective data analysis project
- being able to analyse advantages and disadvantages of different approaches and methods of the data analytics and being able to apply them in simple case studies
- obtain theoretical knowledge about data collection and modelling processes, including state of the art approaches and available best practices

Methodological competence
The students:
- being able to execute typical tasks of data analysis, and also being able to proceed deeper with respect to different approaches and methods
- gain a hands on experience and being able to understand advantages and disadvantages of different methods and being able to use obtained knowledge

Social competence
The students:
- build solutions based on case studies given to the group, for example design of regression model based on provided dataset
- discuss solutions on a technical level
- present obtained case studies solutions as part of the exercises

Self-competence
The students:
- critically review provided offered information

Module contents
After current course students will get advanced knowledge in the domains such as business intelligence and data analytics. Besides that, students will have a chance to have a deeper look into related technical fields such as InMemory Computing, Data Mining and Machine Learning, Big Data Processing with Distributed Systems (e.g. Apache Hadoop / Spark) from both, research and practical, perspectives. Students will be provided with real-world experience gather from business intelligence and data science related projects. Materials of the course are believed to be justified with current demands of data analytics market. Thus, providing students with relevant knowledge in order to give them advantages in future job.

Literaturempfehlungen
- Jürgen Cleve, Uwe Lämmel (2014): "Data mining" (Deutsch)
- Max Bramer (2013): "Principles of data mining" (English)
- Ian Witten, Eibe Frank, Mark Hall (2011): "Data mining: practical machine learning tools and
techniques" (English)

- Jure Leskovec, Anand Rajaraman, Jeffrey Ullman (2014): "Mining of massive datasets" (English)

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**Vorkenntnisse / Previous knowledge**

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<td>56 h</td>
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### Module Contents

- Transport and logistics concepts
- Data acquisition of company logistics
- Planning- and simulation software for complex logistics- and transport processes
- Energy- and resource efficient transport systems
- Resource oriented transport cost calculations (e.g. CO2, noise pollution)
- Planning models for transport infrastructure

### Literature Empfehlungen

- Produktion und Logistik (Springer-Lehrbuch) von Hans-Otto Günther und Horst Tempelmeier von
Links  | http://wi-ol.de
---|---
Languages of instruction  | German, English
Duration (semesters)  | 1 Semester
Module frequency  | jährlich
Module capacity  | unlimited
Reference text  | Dieses Modul ist im Rahmen der Projekte FiIF und FoL konzipiert worden
Module level / module level  | AS (Akzentsetzung / Accentuation)
Moduleart / typ of module  | je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method  | V+Ü
Previous knowledge  | Produktionsorientierte Wirtschaftsinformatik
Examination  | Prüfungszeiten Type of examination
Final exam of module  | At the end of the lecture period Exercises and written exam
Form of instruction  | Comment SWS Frequency Workload of compulsory attendance
Lecture  | 2 SoSe 28
Exercises  | 2 SoSe 28
Präsenzzzeit Modul insgesamt  | 56 h
inf651 - Environmental Management Information Systems I

Module label
Environmental Management Information Systems I

Modulkürzel
inf651

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule NM - interdisziplinär
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule
- Master's Programme Sustainability Economics and Management (Master) > Additional Modules

Zuständige Personen
Marx Gomez, Jorge (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
This module completes the knowledge and abilities gained in the field of Environmental Informatics and it creates a strong reference to up to date topics in the field of sustainability. The content taught in this module can directly be applied in an upcoming study and professional career.

Professional competence
The students:
- are able to classify and explain the sustainability paradigm
- are aware of the current status of sustainability reporting
- are able to define and to model material flows
- have obtained know-how in the field of corporate environmental management information systems (CEMIS)

Methodological competence
The students:
- implement CEMIS
- apply different techniques and methods to case studies
- develop new case studies in teams

Social competence
The students:
- are supposed to work in teams and therefore have to identify working packages and have to take on responsibility for the jobs assigned to them
- present and discuss their own results with the team and the other members of the course

Self-competence
The students:
- learn about their own limitations and learn to accept criticism in order to strengthen their own abilities

Module contents
This course teaches methods, approaches and techniques in the field of information processing in order to support solutions to problems that arise from companies' impact on the environment. In particular, ICT supported approaches of production-integrated environmental protection, environmental controlling and reporting are introduced and discussed. In order to enable the integration of such approaches into environmental protection, environmental management and its systems are taught as well.

The content in detail:
- environmental management as a basis for sustainability
- sustainability and material flow management
- strategic environmental management
- eco-controlling life cycle
- characteristics and system architectures of CEMIS
- standard software systems
- environmental accounting systems
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

Examination

Prüfungszeiten

Type of examination

Final exam of module

At the end of the lecture period

exercises and written exam (max. 120 min.)

Form of instruction

Comment

SWS

Frequency

Workload of compulsory attendance

Lecture

2

SoSe

28

Exercises

2

SoSe

28

Präsenzzeit Modul insgesamt

56 h
inf652 - Production-oriented Business Informatics

Module label                                      Production-oriented Business Informatics
Modulkürzel                                      inf652
Credit points                                    6.0 KP
Workload                                         180 h

Verwendbarkeit des Moduls
- Master’s Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master’s Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen
Sauer, Jürgen (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
The module deepens the contents of the modules „Wirtschaftsinformatik“ and „Wirtschaftsinformatik/Informationsmanagement“. The students will be able to contextualize IT systems and their functions in companies. They are able to participate in the implementation of IT systems in companies. The students know the essential tasks of materials management, production planning and controlling, warehousing, acquisition and supply chain management.

Professional competence
The students:
- name and differentiate the basics of business informatics and information management
- classify IT systems and their functions in companies
- name and characterise the essential tasks of materials management, production planning and controlling, warehousing, acquisition and supply chain management

Methodological competence
The students:
- transfer a holistic development process of production planning and control
- implement IT systems in businesses

Social competence
The students:
- participate in implementing IT systems in companies
- construct and present computational solutions to groups and within their work group
- integrate professional and objective criticism in their own and others’ results

Self-competence
The students:
- recognize the planning horizon for IT systems
- reflect their role and skills to implement IT systems in businesses

Module contents
The module "Production-oriented Business Informatics" deals especially with production planning and control processes affected by process planning tasks, as well as classic problems of industrial production. The lecture is focussed on the application of information systems in industrial production companies. Priorities are order flow business processes and PPS-/ERP-Systems. Case studies and demonstrations illustrate the application of these systems.

Literaturempfehlungen
- Kurbel, Karl: Produktionsplanung und -steuerung im Enterprise Resource Planning und Supply Chain Management, Oldenbourg Verlag, 2005
- Further literature will be announced in the lecture

Links
Language of instruction                           German
Duration (semesters)                             1 Semester
Module frequency                                 jährlich
Module capacity                                  unlimited
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| Präsenzzeit Modul insgesamt | 56 h |
inf653 - ERP Technologies

Module label: ERP Technologies
Modulkürzel: inf653
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
Marx Gomez, Jorge (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module

Learning objectives:
- Generation of understandings into the working approaches and tasks of ERP systems
- Examining components of ERP systems
- Generating knowledge about important aspects of the operation processes of ERP systems, such as data storage and processing, user management, and system maintenance.

Professional competence
The students:
- describe ERP systems in compliance with functions and technologies
- identify state-of-the-art and future architectures of ERP systems
- discuss the usage of core technologies (also in practical case studies, for example with SAP NetWeaver)

Methodological competence:
The students:
- categorize fundamental technologies in combination with other enterprise-wide information systems
- apply the presented methods in practical contexts

Social Competence:
The students:
- construct solutions to given problems in groups
- present solutions to computing science problems before groups

Self-competence:
The students:
- recognize the limits of their capacity in implementing and customizing of business application systems

Module contents
The module provides the following content:
- Overview of the components of ERP systems and their functionality and administration
- In-depth analysis of ERP system architecture under consideration of surface structures and user management in ERP systems, with focus on of data storage, particularly the used data models and database structures, backup and recovery strategies
- Deployment of ERP applications in form of application service providing, including the technical characteristics of this business model, especially Special Administration, delimitation and monitoring tasks for systems, which at the same time be provided several customers

Lecture will be accompanied by SAP case studies.

Literaturempfehlungen


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Vorkenntnisse / Previous knowledge

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Form of instruction | Comment | SWS | Frequency | Workload of compulsory attendance |
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Präsenzzeit Modul insgesamt 56 h
### inf654 - Mobile Commerce

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#### Verwendbarkeit des Moduls
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
- Master's Programme Business Informatics (Master) > Akzentzuweisungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

#### Zuständige Personen
Marx Gomez, Jorge (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

#### Prerequisites

**Skills to be acquired in this module**

**Professional competence**
The students:
- define and encompass MC
- explain the development stages of MC
- are aware of the current developments within MC and are able to classify them
- get to know technical essentials, functionalities and standards of wireless ICT
- assess the fields of application and limitations of wireless ICT
- examine the relevant mobile devices and their respective operating systems, know their characteristics and evaluate their fields of application
- examine market participants, assess business models, optimize business processes
- gain insight into specifics via examples and exercises

**Methodological competence**
The students:
- get to know security aspects and specifics of mobile application design
- prototypically develop an Android application
- prepare and give presentations
- develop a concept of a business model for an Android application

**Social competence**
The students:
- work on their project in groups of three

**Self-competence**
The students:
- reflect their own group-dynamic activities in respect of a mutual goal (successfully finish their project)

#### Module contents
- See above

#### Literaturempfehlungen
- Also all materials provided within the lecture

#### Links
- http://vlba.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
- V+Ü

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### method

**Vorkenntnisse / Previous knowledge**

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**Präsenzzzeit Modul insgesamt** 56 h
inf655 - IT-Controlling

Module label: IT-Controlling
Modulkürzel: inf655
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
Marx Gomez, Jorge (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:
Skills to be acquired in this module:
This module emphasizes the importance of IT-Controlling within an enterprise. The students gain knowledge on practically orientated technologies in order to leave a better understanding for the application and conversion possibilities of IT-Controlling.

Professional competence
The students:
- name general tasks and functions of IT-Controlling.
- recognize the importance strategic IT-Controlling applications.
- learn strategies and methods of IT-Controlling.
- identify the existence of an IT-Strategy as a pre condition of IT-Controlling.
- know about the risks of IT-Outsourcing.
- use IT-Controlling tools (e.g. information systems, portfolio analysis, benchmarking IT-Reporting).

Methodological competence
The students:
- use their knowledge by independently compiled presentations on recent IT-Controlling subjects.

Social competence
The students:
- discuss their results essentially and appropriately in this subject.
- present their subjects to the group.

Self-competence
The students:
- understand and analyse their own state of knowledge.
- reflect their own effects on groups.

Module contents:
The employment of information technologies for enterprises is usually a key factor. By the change of our society to an information society, information gains more and more importance and takes a central role within ICT systems. The specifics of the ICT area cannot be supported by the classical economic controlling. The application of a strategic IT-Controlling becomes more and more important. The result of a study shows that in the meantime in about 80% of the German enterprises an ICT strategy was compiled. However, the study makes also clear, that about two out of three enterprises use no methods of strategic IT-Controlling. The new discipline of IT-Controlling provides plans and methods to avoid isolated applications.

Literaturempfehlungen:
- Gadatsch, A: IT-Controlling: Praxiswissen für IT-Controller und Chief-Information Officer. Springer Verlag, 2012
- Gadatsch, A, Mayer, E: Masterkurs IT-Controlling: Grundlagen und Praxis für ITController und CIOs- Balanced Scorecard- Portfoliomanagement- Wertbeitrag der ITProjektcontrolling-Kennzahlen
  IT-Sourcing- IT-Kosten und Leistungsrechnung. 5 Auflage. Springer Vieweg, 2014

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

Language of instruction:
German

Duration (semesters):
1 Semester

Module frequency:
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| Präsenzzeit Modul insgesamt | 56 h |
inf657 - Product Engineering

Module label: Product Engineering
Modulkürzel: inf657
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen:
Sauer, Jürgen (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:
Focus of this module is to learn and apply the product engineering process. A project will enable the students to design a product from the idea to the prototype. More specifically, a systematic, partial domain-specific, approach to solve technical problems and aspects of project management will be learned. Regular meetings are used to train the presentation capabilities of the students and to schedule working packages within the teams.

Professional competence:
The students:
- learn and try out the handling of virtual and physical prototypes
- learn and try out the construction and validation of virtual prototypes with the aid of CAD-applications
- learn and combine different basic development concepts from the mechanical engineering, microelectronics, control engineering and software engineering

Methodological competence:
The students:
- learn and try out project management concepts
- learn and recognise the connections of different development concepts from different fields, e.g. mechanical engineering, control engineering, microelectronics and software engineering
- develop own products with creativity techniques
- schedule and organise the product development supported by project management techniques independently
- learn the systematic refining of their own product idea with SysML
- design and test products with state-of-the-art CAD-applications

Social competence:
The students:
- impart their structure and mode of action to other people
- develop their own products in small teams
- present their solutions to groups
- integrate criticism to their solutions
- support other groups by giving appropriate criticism

Self-competence:
The students:
- recognise and reflect their own limitations to get familiar and to plan a project in an unknown field (e.g. maritime construction/industries)

Module contents:
This module is a lecture accompanied by a hands-on project. The students work on one product development task. The product development starts with the idea-finding/brainstorming process which is used to create a digital product concept. During the semester a digital prototype will be created and validated by its initial requirements. Finally, a physical prototype is produced with a 3D-Printer (Rapid Prototyping). The progress of the project has to be documented and presented at different milestones.

Literaturempfehlungen:
- Ehrlenspiel (2003): Integrierte Produktentwicklung

Links:
www.wi-ol.de
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<td>Exercises</td>
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<td>2</td>
<td>WiSe</td>
<td>28</td>
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</table>

| Präsenzzeit Modul insgesamt | 56 h |

282 / 373
inf659 - Environmental Management Information Systems II

**Module label**
Environmental Management Information Systems II

**Modulkürzel**
inf659

**Credit points**
6.0 KP

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule
- Master's Programme Sustainability Economics and Management (Master) > Additional Modules

**Zuständige Personen**
Marx Gomez, Jorge (Module responsibility)

**Prerequisites**
Lehrrenden, Die im Modul (Prüfungsberechtigt)

**Skills to be acquired in this module**
This course aims at examining emerging research questions in the field of corporate environmental management information systems (CEMIS). After finishing this course, the students will have extensive knowledge regarding Business Environmental Informatics. In addition, they will be aware of recent research topics and challenges as well as relevant software solutions and practical projects.

**Professional competence**
The students:
- will obtain extensive knowledge in the field of CEMIS
- know emerging research questions and challenges as well as software solutions and projects

**Methodological competence**
The students:
- find their own solutions or apply already existing approaches to new and unsolved questions in the field of CEMIS
- capture required data, analyse it and present it to their team or the whole group

**Social competence**
The students:
- are supposed to work in teams and therefore have to identify working packages and have to take on responsibility for the jobs assigned to them
- present and discuss their own results with the team and the other members of the course

**Self-competence**
The students:
- learn about their own limitations and learn to accept criticism in order to strengthen their own abilities

**Module contents**
A strong social pressure forces enterprises to question their current way of implementing their business and to include different aspects of sustainability into their strategies and operational actions. Such a rethinking of one's business is supported by corporate environmental management information systems. Such systems aim at optimising the energy and resource usage, emission and waste minimisation as well as production integrated environmental protection. Of course they support the fulfillment of legal requirements such as waste management or hazardous material handling.

The module will cover:
- recent and emerging research questions and topics related to the field of CEMIS as well as Business Environmental Informatics.
- discussion and hands-on experience of standard software systems and newly established solutions.
- applying the knowledge obtained to the definition of new as well as on solving new case studies.

**Literaturempfehlungen**

Hershey (PA), London

• Möller, A. (2000): Grundlagen stoffstrombasierter Betrieblicher Umweltinformationssysteme. Projekt Verlag
• Rautenstrauch, C. (1999), Betriebliche Umweltinformationssysteme, Springer-Verlag

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

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Reference text
Type and language of program will be announced prior to the beginning of the course

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
V (2 SWS), Ü (2 SWS) oder SE
Nach Ankündigung zu Beginn der Veranstaltung (2SWS V + 2 SWS Ü oder Blockseminar)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
Usually 2 weeks after the end of the lecture period
Seminar paper and presentation or term paper

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2
WiSe
28

Exercises
2
WiSe
28

Präsenzzeit Modul insgesamt
56 h
inf660 - Sustainability Informatics

<table>
<thead>
<tr>
<th>Module label</th>
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<tbody>
<tr>
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<td>inf660</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td></td>
<td>Type and language of program will be announced prior to the beginning of the course. The course is recognised as a practical project in the Master's programme Sustainability Economics and Management.</td>
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</table>

Verwendbarkeit des Moduls

- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen

Marx Gomez, Jorge (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

After finishing this course, students should be able to set up a sustainability report tailormade for different target groups for any kind of organization. The students will be enabled to know and apply different available standards and guidelines as well as to estimate the influence of data defects and the feasibility of recent information and communication technology. This course emphasizes the importance of sustainability reporting as a means of an organization's communication (internal and external) and provides an overview on relevant indicators, standards and guidelines. Based on that the handling of data defects and missing data as well as different approaches of reporting will be discussed. In addition, the specific requirements of different target groups regarding content and presentation of a report will be discussed as well.

Professional competence

The students:

- are aware of different indicators, standards and guidelines and know when to apply which.
- know different approaches of data capturing, interpolation of missing or corrupt data as well as the influence of each of these issues on the validity of a report.
- implement concepts for tailormade target group orientation.

Methodological competence

The students:

- prepare a small sustainability report based on their decision which standard or guideline to use.
- capture existing data and analyse it.
- prepare a tailormade target oriented presentation of their results.

Social competence

The students:

- are supposed to work in teams and therefore have to identify working packages and have to take on responsibility for the jobs assigned to them.
- present and discuss their own results with the team and the other members of the course

Self-competence

The students:

- learn about their own limitations and learn to accept criticism in order to strengthen their own abilities

Module contents

The following topics will be covered in this module:

- different definitions of the term sustainability.
- the importance of sustainability reporting as a means of an organisation's communication.
- LCA, environmental accounting, supply chain management as data sources.
- semantic, comparability and transformation of indicators, standards and guidelines.
- interpolation and interpretation of data defects.
- how to report (e.g. knowledge management, document engineering, integrated reporting, different target groups).
Literaturempfehlungen


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

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency

Module capacity
unlimited

Reference text
Die Lehrveranstaltung wird im Masterstudiengang Sustainability Economics and Management als practical project anerkannt.

Modullevel / module level
AC (Aufbaucurriculum / Composition)

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
Seminar paper and presentation or exercises and exam

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2
SoSe
28

Übung oder Praktikum
2
SoSe
28

Präsenzzeit Modul insgesamt
56 h
inf661 - Digital Transformation

<table>
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<tr>
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<tr>
<td>Workload</td>
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<tr>
<td>Zuständige Personen</td>
<td>Marx Gomez, Jorge (Module responsibility)</td>
</tr>
<tr>
<td>Lehrende, Die im Modul (Prüfungsberechtigt)</td>
<td></td>
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</table>

**Prerequisites**

**Skills to be acquired in this module**

After successful completion of the lecture, the students should be able to define enabler and actors of a digital transformation within the context of a model company. Furthermore, key competences such as Cloud Computing or IoT are used to make potential exploitation by new digital business models visible. The results will be evaluated. The lecture explains basic properties of a digital transformation for companies and shows specific development potential. By forming and building a model company, students are able to create a realistic and practical scenario. A final documentation reveals the degree of fulfilment and the students point of view on the scenario.

**Professional competence**
The students:

- recognize basic properties and facts of a digital transformation for companies
- devise different terms of digital transformation
- expose actual introduction projects
- compile practical knowledge by dividing goals of enabler and actors of a digital transformation
- obtain basic knowledge of key competences such as IT-Security, Data Analytics, Big Data, Cloud Computing
- identify digital business models within the specific development potential

**Methodological competence**
The students:

- determine and analyse required information
- prepare the given information for specific target groups
- establish an analytical understanding of digital enterprise structures within key competences and applications

**Social competence**
The students:

- work in groups, identify work packages and take on responsibility for the jobs assigned to them
- discuss and introduce the results on a functional level

**Self-competence**
The students:

- reflect their actions on the basis of self defined objectives
- analyse their own state of knowledge

**Module contents**

Within the lecture the upcoming topics are discussed:

- definition and introduction of digital transformation
- success factors, market changes and introductory projects
- enabler of a digital transformation (competences, applications and structures)
- digital business models and networks
- actors of a digital transformation
- industry 4.0 in the context of a digital transformation

**Literatureempfehlungen**


<table>
<thead>
<tr>
<th>Links</th>
<th><a href="http://www.wi-ol.de">http://www.wi-ol.de</a></th>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>After the end of the lecture period</td>
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<tr>
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<td>56 h</td>
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<tr>
<td>Workload of compulsory attendance</td>
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inf663 - Application Area Maritime

<table>
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<tr>
<td>Workload</td>
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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

**Zuständige Personen**
- Boll-Westermann, Susanne (Module responsibility)
- Fatikow, Sergej (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**

**Skills to be acquired in this module**

**Professional competences:** The students gain knowledge about ship handling and navigation and learn to understand maritime transportation as a system of systems with systems on board for stability, propulsion and steering as for bridge resource management. They understand the latter as a major contribution to organize navigation as a hierarchical team concept of a safety critical sociotechnical system. The students are aware of the special technical and physical challenges of navigation. **Methodological competences:** The students can apply system engineering methods to describe, analyse and design maritime systems. By looking on maritime transportation the gain transferable knowledge on other cyber physical systems. Students learned how systems can deal with harsh environmental conditions in a resilient way. **Social competences:** Maritime transportation is a major basis of a global economy. Typically, students do not have an understanding of these transportation systems nor their technical and systemic challenges. Therefore, the student knows the concepts of maritime transportation and its role in international transportation networks after finishing this module. **Self-Competences:** Especially their competences cover an understanding as maritime transportation as a systems of systems with high requirements on reliability, dependability and safety in combination with efficiency to be competitive in a global economy.

**Module contents**
The module consists of a lecture and an exercise part: Lecture: Maritime Transportation in global and local supply chains, Base concepts of ship handling and navigation, maritime system dynamics, bridge resource management, eNAVigation and high automation systems. Seminar: Covering aspects of maritime transportation

**Literaturempfehlungen**
Bernhard Berking, Werner Huth (Herausgeber), Handbuch Nautik 1: Navigatorische Schiffsführung, Seehafen Verlag, 2010

**Links**

**Language of instruction**
- English

**Duration (semesters)**
- 1 Semester

**Module frequency**
- Once a year

**Module capacity**
- unlimited

**Modulart / typ of module**
- Pflicht o. Wahlpflicht / compulsory or optional

**Lehr-/Lernform / Teaching/Learning method**
- V+S

**Vorkenntnisse / Previous knowledge**

**Examination**
- Prüfungszeiten
- Type of examination

**Final exam of module**
- At the end of the lecture period
- Oral exam and documentation

**Form of instruction**

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<td>SoSe und WiSe</td>
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<tr>
<td>Seminar</td>
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<td>SoSe und WiSe</td>
<td>28</td>
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**Präsenzzeit Modul insgesamt**
- 56 h
### Prerequisites

**Skills to be acquired in this module**

This module integrates current developments in the field in adequate study courses.

#### Professional competences

The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences

The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences

The students:
- support team process by their abilities

#### Self-competences

The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

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### Module contents

See assigned course description

### Literature recommendations

As announced in course

### Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modulelevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method: 2 Veranst. aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge

Examination: Prüfungszeiten
Type of examination: Portfolio or presentation or oral exam

Form of instruction: VA-Auswahl

SWS: 2

Frequency: SoSe oder WiSe

Workload Präsenzzeit: 28 h
inf692 - Special Topics in 'Business Informatics' III

Module label: Special Topics in 'Business Informatics' III
Modulkürzel: inf692
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
- Marx Gomez, Jorge (Module responsibility)
- Sauer, Jürgen (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:
This module integrates current developments in the field, especially with a focus on business intelligence, in adequate study courses.

Professional competences:
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences:
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences:
The students:
- support team process by their abilities

Self-competences:
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents:
See assigned course description

Literaturempfehlungen:
As announced in course

Links:

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method: 2 Veranst. aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten
Type of examination

Final exam of module:
At the end of the lecture period
Portfolio or presentation or oral exam

Form of instruction:
VA-Auswahl

SWS:
2
Frequency:
SoSe oder WiSe
Workload Präsenzzzeit:
28 h
inf691 - Special Topics in 'Business Informatics' II

Module label  
Special Topics in 'Business Informatics' II

Modulkürzel  
inf691

Credit points  
6.0 KP

Workload  
180 h

Verwendbarkeit des Moduls  
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen  
Marx Gomez, Jorge (Module responsibility)
Sauer, Jürgen (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites  
This module integrates current developments in the field, especially with a focus on corporate environmental management information systems, in adequate study courses.

Professional competences  
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences  
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences  
The students:
- support team process by their abilities

Self-competences  
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents  
See assigned course description

Literaturempfehlungen  
As announced in course

Links  

Language of instruction  
German

Duration (semesters)  
1 Semester

Module frequency  
unregelmäßig

Module capacity  
unlimited

Modulart / typ of module  
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method  
2 Veranst. aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge  

Examination  
Prüfungszeiten

Final exam of module  
At the end of the lecture period

Type of examination  
Portfolio or presentation or oral exam

Form of instruction  
VA-Auswahl

SWS  
2

Frequency  
SoSe oder WiSe

Workload Präsenzezeit  
28 h
inf693 - Special Topics in 'Business Informatics' IV

Module label: Special Topics in 'Business Informatics' IV
Modulkürzel: inf693
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
- Marx Gomez, Jorge (Module responsibility)
- Sauer, Jürgen (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:
This module integrates current developments in the field in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- evaluate and apply tools, technology and methods sophisticatedly
- 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 competences
The students:
- support team process by their abilities

Self-competences
The students:
- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently

Module contents:
See assigned course description

Literaturempfehlungen:
As announced in course

Links:
- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modullevel / module level: AS (Akzentsetzung / Accentuation)
- Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
- Lehr-/Lernform / Teaching/Learning method: 2 Veranst. aus V, S, Ü, P, PR (4SWS)

Vorkenntnisse / Previous knowledge:

Examination: Prüfungszeiten
Type of examination: Form of instruction: VA-Auswahl

Final exam of module: At the end of the lecture period
Portfolio or presentation or oral exam

Form of instruction: VA-Auswahl

SWS: 4
Frequency: SoSe oder WiSe
Workload Präsenzzeit: 56 h
inf694 - Current Topics in 'Business Informatics' I

<table>
<thead>
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<tr>
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| Verwendbarkeit des Moduls | • Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik  
• Master's Programme Computing Science (Master) > Angewandte Informatik |
| Zuständige Personen | Marx Gomez, Jorge (Module responsibility)  
Sauer, Jürgen (Module responsibility)  
Lehrenden, Die im Modul (Prüfungsberechtigt) |

### Prerequisites

This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:
- communicate with users and experts convincingly

**Self-competences**
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

### Module contents
See assigned course description

### Literatureempfehlungen
As announced in course

### Links

#### Language of instruction
German

#### Duration (semesters)
1 Semester

#### Module frequency
unregelmäßig

#### Module capacity
unlimited

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

#### Lehr-/Lernform / Teaching/Learning method
S oder V (2 SWS)

#### Vorkenntnisse / Previous knowledge

<table>
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<th>Prüfungszeiten</th>
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<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>Presentation or oral exam</td>
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#### Form of instruction
Course or seminar

#### SWS
2

#### Frequency
SoSe oder WiSe

#### Workload Präsenzzzeit
28 h
## inf695 - Current Topics in 'Business Informatics' II

### Module label
Current Topics in 'Business Informatics' II

### Modulkürzel
inf695

### Credit points
3.0 KP

### Workload
90 h

### Verwendbarkeit des Moduls
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

### Zuständige Personen
Marx Gomez, Jorge (Module responsibility)
Sauer, Jürgen (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

### Prerequisites

### Skills to be acquired in this module
This module integrates current developments in the field, especially with a focus on corporate environmental management information systems, in adequate study courses.

#### Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

#### Social competences
The students:
- communicate with users and experts convincingly

#### Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

### Module contents
See assigned course description

### Literaturempfehlungen
As announced in course

### Links

### Language of instruction
German

### Duration (semesters)
1 Semester

### Module frequency
unregelmäßig

### Module capacity
unlimited

### Modulart / type of module
je nach Studiengang Pflicht oder Wahlpflicht

### Lehr-/Lernform / Teaching/Learning method
S oder V (2 SWS)

### Vorkenntnisse / Previous knowledge

### Examination
Prüfungszeiten
Type of examination

#### Final exam of module
At the end of the lecture period
Presentation or oral exam

### Form of instruction
Course or seminar

### SWS
2

### Frequency
SoSe oder WiSe
| Workload Präsenzzeit | 28 h |
inf696 - Current Topics in 'Business Informatics' III

Module label | Current Topics in 'Business Informatics' III
---|---
Modulkürzel | inf696
Credit points | 3.0 KP
Workload | 90 h

Verwendbarkeit des Moduls
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen
Marx Gomez, Jorge (Module responsibility)
Sauer, Jürgen (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
This module integrates current developments in the field, especially with a focus on business intelligence, in adequate study courses.

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:
- communicate with users and experts convincingly

Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturempfehlungen
As assigned in course

Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | unregelmäßig
Module capacity | unlimited
Modulart / module level | AS (Akzentsetzung / Accentuation)
Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method | S oder V (2 SWS)

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
At the end of the lecture period
Presentation or oral exam
Form of instruction
Course or seminar

SWS
2
Frequency
WiSe
| Workload Präsenzzzeit | 28 h |
inf697 - Current Topics in 'Business Informatics' IV

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**Verwendbarkeit des Moduls**
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodulle der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik

**Zuständige Personen**
- Marx Gomez, Jorge (Module responsibility)
- Sauer, Jürgen (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:
- communicate with users and experts convincingly

**Self-competences**
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

**Module contents**
See assigned course description

**Literaturempfehlungen**
As assigned in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**
S oder V (2 SWS)

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten

**Final exam of module**
At the end of the lecture period
Presentation or oral exam

**Form of instruction**
Course or seminar

**SWS**
2

**Frequency**
WiSe

**Workload Präsenzzeit**
28 h
inf810 - Special Topics in Computer Science I

Module label: Special Topics in Computer Science I
Modulkürzel: inf810
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule

Zuständige Personen:
Lehrenden, Die im Modul (Prüfungsberechtigt)
Marx Gomez, Jorge (Module responsibility)

Prerequisites:

Skills to be acquired in this module:

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

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

Social competence:
The students:
- work in a team

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

Module contents:
According to the assigned task

Literaturempfehlungen:
According to the assigned task

Links:

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: Sommer und Winter
Module capacity: unlimited
Modullevel / module level: AS (Akzentsetzung / Accentuation)
Modulart / typ of module: Wahlmodul / Opportunity
Lehr-/Lernform / Teaching/Learning method: 4 aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge:

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

Form of instruction: VA-Auswahl

SWS: 4
Frequency: SoSe oder WiSe
Workload: Präsenzzeit: 56 h
inf811 - Special Topics in Computer Science II

**Module label**  
Special Topics in Computer Science II

**Modulkürzel**  
inf811

**Credit points**  
6.0 KP

**Workload**  
180 h

**Verwendbarkeit des Moduls**  
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik  
- Master's Programme Computing Science (Master) > Angewandte Informatik  
- Master's Programme Environmental Modelling (Master) > Mastermodule

**Zuständige Personen**  
Marx Gomez, Jorge (Module responsibility)  
Fränzle, Martin Georg (Module responsibility)  
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**  
This module integrates current computer science developments into the business informatics program, especially considering the selected focus area, by appropriate study courses.

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

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

**Social competence**  
The students:  
- work in a team

**Self-competence:**  
The Students:  
- Plan their informatical actions independently

**Module contents**  
According to the assigned task

**Literaturempfehlungen**  
According to the assigned task

**Language of instruction**  
German

**Duration (semesters)**  
1 Semester

**Module frequency**  
Sommer und Winter

**Module capacity**  
unlimited

**Modullevel / module level**  
AS (Akzentsetzung / Accentuation)

**Modular / typ of module**  
Wahlmodul / Opportunity

**Lehr-/Lernform / Teaching/Learning method**  
4 aus V, Ü, S, P, PR

**Vorkenntnisse / Previous knowledge**  

**Examination**  
Prüfungszeiten  
Type of examination  
Final exam of module  
Exercises or presentation or oral exam or written exam

**Form of instruction**  
VA-Auswahl

**SWS**  
2

**Frequency**  
SoSe oder WiSe

**Workload Präsenzzzeit**  
28 h
inf812 - Current Topics in Computer Science I

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<td>Transfer computer science methods and development models to IT application area requirements</td>
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<tr>
<td>Evaluate the possibilities and limitations of computer science methods and tools and apply them appropriately</td>
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<td>The students: Review problems, formulate them with formal models and explore them appropriately</td>
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<td>Identify and present (one or more) computer science problem solutions</td>
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<td>Vorkenntnisse / Previous knowledge</td>
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<td>Examination</td>
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<td>Workload Präsenzzeit</td>
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Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: Sommer und Winter

Module capacity: unlimited

Modulelevel / module level: AS (Akzentsetzung / Accentuation)

Modulart / typ of module: Wahlmodul / Opportunity

Lehr-/Lernform / Teaching/Learning method: 2 aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge: According to the assigned task

Examination: Prüfungszeiten

Final exam of module: Exercises or presentation or oral exam or written exam
inf813 - Current Topics in Computer Science II

Module label: Current Topics in Computer Science II
Modulekürzel: inf813
Credit points: 3.0 KP
Workload: 90 h

Verwendbarkeit des Moduls:
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodul der Informatik
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule

Zuständige Personen:
Lehrende, Die im Modul (Prüfungsberechtigt)
Marx Gomez, Jorge (Module responsibility)
Fränzle, Martin Georg (Module responsibility)

Prerequisites:
This module integrates current computer science developments into the business informatics program, especially considering the selected focus area, by appropriate study courses.

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

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

Social competence
The students:
- work in a team

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

Module contents:
According to the assigned task

Literaturempfehlungen:
According to the assigned task

Language of instruction:
German

Duration (semesters):
1 Semester

Module frequency:
Sommer und Winter

Module capacity:
unlimited

Modullevel / module level:
AS (Akzentsetzung / Accentuation)

Modulart / typ of module:
Wahlmodul / Opportunity

Lehr-/Lernform / Teaching/Learning method:
2 aus V, Ü, S, P, PR

Vorkenntnisse / Previous knowledge:

Examination Prüfungszeiten Type of examination
Final exam of module Exercises or presentation or oral exam or written exam

Form of instruction:
VA-Auswahl

SWS:
2

Frequency:
SoSe oder WiSe

Workload Präsenzzeit:
28 h
inf701 - Computer Science Education II

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Verwendbarkeit des Moduls
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule
- 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) > Pflichtbereich
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen
- Diethelm, Ira (Module responsibility)
- 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
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### Vorkenntnisse / Previous knowledge

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### Form of instruction

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| Präsenzzeit Modul insgesamt | 56 h |
inf703 - Computer Science Education III

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**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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**Vorkenntnisse / Previous knowledge**

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**Präsenzzeit Modul insgesamt** 56 h
inf705 - Practical in Computer Science Education

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<td>Zuständige Personen</td>
<td>Diethelm, Ira (Module responsibility) Lehrenden, Die im Modul (Prüfungsberechtigt)</td>
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</table>

### Prerequisites

**Skills to be acquired in this module**

#### Professional competence

The students:
- know hard- and software system engineering approaches and use them in practice
- make a qualified and contextual choice of hard- and software designing approaches
- characterise and consider challenges of soft- and hardware systems in education

#### Methodological competence

The students:
- know engineering approaches and use them in new contexts
- evaluate decision making concepts and use them in different domains

#### Social competence

The students:
- cooperate with team members during the development process
- recognize package tasks and resume their responsibilities
- analyse team conflicts and resolve them
- document the software development process in a team
- moderate team meetings and decision making processes appropriately

#### Self-competence

The students:
- reflect their self-perception with regard to the implementation of software systems

### Module contents

A hard- or software system for education will be designed in this practical course. The requirements analysis of hard- or software systems and the dealing with customers are the main topics of this practical course.

### Literaturempfehlungen

As announced in course

### 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**

P

### Vorkenntnisse / Previous knowledge

**Examination**

Prüfungszeiten

**Type of examination**

Practical implementation, presentation and oral exam

**Final exam of module**

At the end of the semester

**Form of instruction**

Practical training

**SWS**

4
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**inf711 - Special Topics in 'Computer Science Education' II**

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**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Angewandte Informatik

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

**Prerequisites**
- This module integrates current developments in the field in adequate study courses.

**Skills to be acquired in this module**

**Professional competences**
- The students:
  - define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
  - recognise and evaluate applied techniques and methods of their subject and are aware of their limits
  - 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
  - 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 competences**
- The students:
  - evaluate and apply tools, technology and methods sophisticatedly
  - 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 competences**
- The students:
  - support team process by their abilities

**Self-competences**
- The students:
  - pursue the overall and special computer science development critically
  - implement innovative professional activities effectively and independently

**Module contents**
- See assigned course description

**Literaturempfehlungen**
- As announced in course

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- unregelmäßig

**Module capacity**
- unlimited

**Modullevel / module level**
- AS (Akzentsetzung / Accentuation)

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

**Lehr-/Lernform / Teaching/Learning method**
- 2 Veranstaltungen aus V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**

**Examination**
- Prüfungszeiten

**Final exam of module**
- At the end of the lecture period
- Portfolio or presentation or oral exam

**Form of instruction**
- VA-Auswahl
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inf712 - Current Topics in Computer Science Education I

### Module label
Current Topics in Computer Science Education I

### Modulkürzel
inf712

### Credit points
3.0 KP

### Workload
90 h

### Verwendbarkeit des Moduls
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule
- 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) > Pflichtbereich
- Master's Programme Computing Science (Master) > Angewandte Informatik

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

### Prerequisites

#### Skills to be acquired in this module
This module integrates current developments in the field in adequate study courses.

**Professional competences**
The students:

- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences**
The students:

- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

**Social competences**
The students:

- communicate with users and experts convincingly

**Self-competences**
The students:

- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

### Module contents
See assigned course description

### Literatureempfehlungen
As announced in course

### Links

#### Language of instruction
German

#### Duration (semesters)
1 Semester

#### Module frequency
unregelmäßig

#### Module capacity
unlimited

#### Module level / module level
AS (Akzentsetzung / Accentuation)

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

#### Lehr-/Lernform / Teaching/Learning
S oder V
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inf713 - Current Topics in 'Computer Science Education' II

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Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Angewandte Informatik

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

Prerequisites

Skills to be acquired in this module

Professional competences
The students:
- define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general
- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- 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
- 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 competences
The students:
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research
- schedule time processes and resources

Social competences
The students:
- communicate with users and experts convincingly

Self-competences
The students:
- pursue the overall and special computer science development critically
- develop and reflect self-developed hypotheses to theories independently

Module contents
See assigned course description

Literaturempfehlungen
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modulelevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method
S oder V

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination

Final exam of module
At the end of the lecture period
Presentation or oral exam
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### inf592 - Special Topics in 'Applied Artificial Intelligence' II

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SWS | Frequency | Workload of compulsory attendance |
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2   | 28  | 28
2   | 28  | 28
inf593 - Special Topics in 'Applied Artificial Intelligence' I

Module label: Special Topics in 'Applied Artificial Intelligence' I
Modulkürzel: inf593
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Computing Science (Master) > Angewandte Informatik

Zuständige Personen:
- Sonnenschein, Michael (Module responsibility)
- Lehrenden, Die im Modul (Module counselling)
- Möbus, Claus (Prüfungsberechtigt)

Prerequisites:

Skills to be acquired in this module:
Das Modul hat zum Ziel aktuelle Entwicklungen im Vertiefungsgebiet "Lernende und Kognitive Systeme" II in den jeweils angemessenen Lehrveranstaltungsformen in das Studium zu integrieren.

Fachkompetenzen:
- differenzieren und kontrastieren einen Teilbereich der Informatik, auf den sie sich spezialisiert haben, im Detail genauer oder reflektieren die Informatik im Allgemeinen
- erkennen und beurteilen die in ihrem Spezialgebiet anzuwendenden Techniken und Methoden und deren Grenzen
- identifizieren, strukturieren und lösen Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin
- wenden dem Stand der Wissenschaft entsprechende und innovative Methoden bei der Untersuchung und Lösung von Problemen an, gegebenenfalls unter Rückgriff auf andere Disziplinen
- erkennen die Grenzen des heutigen Wissenstands und der heutigen Technik und tragen zur weiteren wissenschaftlichen und technologischen Entwicklung der Informatik bei
- diskutieren aktuelle Entwicklungen der Informatik und beurteilen deren Bedeutung

Methodenkompetenzen:
- evaluieren Werkzeuge, Technologien und Methoden und wenden diese differenziert an
- entwickeln kreativ neue und originäre Vorgehensweisen und Methoden
- reflektieren Probleme auch in neuen oder erst im Entstehen begriffenen Bereichen ihrer Disziplin und wenden Informatik-Methoden zur Untersuchung und Lösung an

Sozialkompetenzen:
- integrieren ihre Fähigkeiten in Teamprozesse

Selbstkompetenzen:
- verfolgen die weitere Entwicklung in der Informatik allgemein und in ihrem Spezialgebiet kritisch
- führen innovative Tätigkeiten in ihrem Berufsfeld erfolgreich und eigenverantwortlich aus

Module contents:
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Literaturempfehlungen:
je nach Vertiefungsgebiet und zugeordneter Lehrveranstaltung

Links

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

Modulelevel / module level:

Modulart / typ of module:
Lehr-/Lernform / Teaching/Learning method: 2 Veranstaltungen aus V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge
Examination:
- Prüfungszeiten
- Type of examination
Final exam of module:
- Am Ende der Vorlesungszeit nach Absprache mit dem Lehrenden
- Fachpraktische Übungen und Referat oder Mündliche Prüfung

Form of instruction:

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Präsenzzeit Modul insgesamt: 56 h
Nicht Informatik

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) > Wahlpflchtmodule (Technische Informatik)
- Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen

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

Prerequisites

Skills to be acquired in this module

Professional competence:
The students:

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

Methodological competence:
The students:

- Transfer calculation methods onto complex dynamic systems
- Implement electrical system models

Social competence:
The students:

- Present solutions for specific questions

Self-competence:
The students:

- Reflect their solutions by using methods learned in this course

Module contents

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

Literaturempfehlungen

essential:

- slides
recommended:


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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) > Wahlpflichtmodule (Technische Informatik)
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen
Fatikow, Sergej (Module responsibility)
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, magnetostriuctive, electromagnetic, SMA-based, thermomechanical, electro rheological and other actuators); microsensors: principles and examples (force and pressure, position and speed, acceleration, biological and chemical, temperature and other sensors); MST and information processing; microsystem design and simulation; classification of microrobots; coarse positioning of a microrobot; fine positioning of a microrobot; handling of microparts: problems and solutions; micro grasp techniques; microassembly; process automation by microrobots; desktop robot cell in SEM

Literatureempfehlungen
Essential:
Lecture notes

Recommended:


Secondary Literature (only available for some subareas):

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

Links

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<td>Vorkenntnisse / Previous knowledge</td>
<td>Analysis II oder Numerik</td>
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<td>Comment</td>
<td>Frequency</td>
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### inf209 - Control Theory

<table>
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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) > Wahlpflichtmodule (Technische Informatik)  
• Master's Programme Computing Science (Master) > Nicht Informatik |
| Zuständige Personen | Fatikow, Sergej (Module responsibility)  
Hein, Andreas (Module responsibility)  
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 |
| Literatureempfehlungen | • 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 |

<p>| Links | 327 / 373 |</p>
<table>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>V+Ü</td>
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| Vorkenntnisse / Previous knowledge | - Differenzialgleichungen  
- Analysis II  
- Grundlagen der Elektrotechnik |

**Examination**

<table>
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<th>Final exam of module</th>
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<th>Hands-on exercises and written or oral exam</th>
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**Form of instruction**

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

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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) > Wahlpflichtmodule (Technische Informatik)
- Master's Programme Computing Science (Master) > Nicht Informatik

**Zuständige Personen**
- Hein, Andreas (Module responsibility)
- Fränzle, Martin Georg (Module responsibility)
- Lehrende, 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
-Grünigen, D. C. v.; Digitale Signalverarbeitung: mit einer Einführung in die kontinuierlichen Signale und Systeme
-Tönnes, 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

Links
Language of instruction  German
Duration (semesters)  1 Semester
Module frequency  jährlich
Module capacity  unlimited
Module level / module level  AS (Akzentsetzung / Accentuation)
Modular / typ of module  je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method  V+Ü

Vorkenntnisse / Previous knowledge  Modul math040 Analysis II b: Differentialrechnung mehrerer Variablen
Examination  Prüfungszeiten  Type of examination
Final exam of module  At the end of the semester  Hands-on exercises and written or oral exam
Form of instruction  Comment  SWS  Frequency  Workload of compulsory attendance
Lecture  2  WiSe  28
Exercises  2  WiSe  28

Präsenzzeit Modul insgesamt  56 h
inf305 - Medical Technology

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Verwendbarkeit des Moduls

- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen

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

Prequisites

Skills to be acquired in this module

Professional competence
The students:
- Describe medical diagnosis and therapy methods
- Understand the core concepts of computer-assisted medical interventions
- Are aware of the basic concepts and legal conditions of the development of medical devices
- Define the character of medical devices' software parts and implement them
- Assess the complex interaction of medical products and patients
- Get familiar with the development of medical products within a short period of time

Methodological competence
The students:
- Recognise the interdisciplinary challenges and accordingly exchange information with other disciplines

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

- Medical areas and areas of application
- Basic requirements for medical systems (hygiene, MPG, technical security, materials)
- Medical systems:
  - Functional diagnostics (ECG, EMG, EEG)
  - Imaging systems (CT, MRI, ultrasound, PET, SPECT) - Therapy equipment (Laser, RF, Microtherapy)
  - Signal processing / monitoring (cardiovascular, hemodynamic, respiratory, metabolic, cerebral)
- Medical Informatics (HIS, DICOM, Telemedicine, VR, image processing).

Literaturempfehlungen

essential:
- Lecture slides

recommended:
secondary literature:


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<td>- Regelungstechnik</td>
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inf307 - Robotics

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Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master’s Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen
Hein, Andreas (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module

Professional competence
The students:
- Name and know the functions and applications of robot systems
- Characterise the basic concepts to program robot systems
- Differentiate between the interaction of mechanical, electrical and software components

Methodological competence
The students:
- Define characteristics and components of robot systems for a specific application
- Design and implement robot system sub-components
- Design and parameterise simple control structures
- Plan the application of robot systems and derive the requirements
- Model electrical and mechanical systems
- Develop and realise simple robot systems

Social competence
The students:
- Solve robot systems problems in team work

Self-competence
The students:
- Reflect their solutions in reference to robot system methods

Module contents
- Integration in production plants / aims / subsystems
- Architectures / classifications (classification of robots)
- Robot components « Computer systems for programming
  - PA-10
    - Lego Mindstorms
- Basics of kinematics
  - Coordinate transformation, homogeneous coordinates, Coordinate transitions
  - Kinematic equation systems, transformation of vectors
- Kinematic
  - Joint types (manipulators) / Wheels, TCP
  - Denavit-Hartenberg-Transformation
  - Forward calculation
  - Backward calculation
- Sensors
  - General properties of sensors, parameter
  - Simple optical position sensors
  - Inductive-, capacitive- und ultrasonic-sensors
  - Distance sensors (laser scanner, triangulation sensors)
  - Force sensors
  - Sensor data preparation
- Planing / Regulation
  - Overall regulation approach, terms, process- and control functions, PID-controller
  - Planning concepts and approaches (On-Line, Off-Line), planning processes, construction and path planning
- Actuators

**Literatureempfehlungen**

**essential:**
lecture nodes

**recommended:**

**secondary literature:**

**Links**

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**Vorkenntnisse / Previous knowledge**

**Examination**

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| Präsenzzeit Modul insgesamt | 56 h |

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334 / 373
inf308 - Microrobotics II

Module label
Microrobotics II

Modulkürzel
inf308

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Computing Science (Master) > Technische Informatik
- Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering

Zuständige Personen
Fatikow, Sergej (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
After having given an established introduction in the module "Microrobotics and Microsystem Technology" this lecture offers a further specialisation in microrobotics. Within the course, all relevant areas (among others the research topics of the division "Microrobotics and Control Engineering (AMiR)") will be presented and analysed. The student will be provided with an insight into current research projects of AMiR and of other research institutes of microrobotics worldwide; here mainly the requirements of industry to microrobots will be discussed. The lecture will be enhanced by practical courses in the research laboratories of AMiR.

Professional competence
The students:
- name and recognise the basic concepts of nanotechnology, in particular, micro- and nanorobotics approaches
- differentiate the development, control and application of micro- and nanorobotics systems
- implement and design application-specific micro- and nanorobotics systems

Methodological competence
The students:
- transfer their control engineering and image processing abilities on interdisciplinary problems
- transfer their hands-on experience to develop controls and applications of microrobotic systems on new tasks

Social competence
The students:
- work in a team

Self-competence
The students:
- reflect their problem-solving behaviour and use hands-on experience to develop, control and application of microrobotics

Module contents
Smart and versatile microrobots; microactuators (piezo-, ferrofluid- and SMA-actuators) for microrobots; real-time image processing in the micro world (SEM, optical microscopy); micro force sensors and tactile sensors for microrobots; microrobot control systems, e.g. neural networks and fuzzy logic; haptic interface for the control of microrobots; neural speech interface for the control of microrobots; robot-based micro- and nanohandling (SEM, optical microscopy); applications: microassembly, nano-testing, cell handling; Micro Air Vehicles (MAVs); multi-robot systems: team behavior, communication, control issues

Literaturempfehlungen
- Lecture notes (can be obtained in secretariate, A1-3-303)

Links

Languages of instruction
English, German
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inf524 - Introduction to Medicine for Computer Science Students

Module label
Introduction to Medicine for Computer Science Students

Modulkürzel
inf524

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls
- Master's Programme Computing Science (Master) > Angewandte Informatik
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen
Kaspar, Mathias (Module responsibility)
Lehrende, Die im Modul (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
**Ziele des Moduls:** Das Ziel des Moduls ist den Studierenden ein Basiswissen aus der Humanmedizin zu vermitteln. Dies soll bei einer Berufsauswahl oder Schwerpunkten der Medizinischen Informatik / Medizintechnik das Verständnis der Domäne erleichtern und Grundlagen für eigene Fragestellungen und Ideen zur Anwendung von Methoden der Informatik in der Medizin führen. **Fachkompetenzen** Die Studierenden:
- lernen die Grundlagen der medizinischen Terminologie (Terminologia Anatomica) und Anatomie des menschlichen Körpers kennen und können die wichtigsten Strukturen in der Fachsprache benennen - kennen die Grundlagen der Physiologie des menschlichen Körpers und können die wesentlichen Körper- funktionen beschreiben - erhalten Einblicke in pathophysiologische Vorgänge des menschlichen Körpers und die damit verbundenen Auswirkungen auf die Funktion des menschlichen Organismus - kennen Regelkreise des menschlichen Körpers zur Aufrechterhaltung wichtiger körperlicher Funktionen und wissen, dass diese Regelkreise als Möglichkeit in Vorgänge des menschlichen Körpers einzugreifen genutzt werden können - kennen Referenzwerte wichtiger physiologischer Parameter und können Schlussfolgerungen auf Körperfunktionen ableiten **Methodenkompetenzen** Die Studierenden:
- kennen die sich aus den physiologischen Vorgängen des menschlichen Körpers ergebenen möglichen Messverfahren - wenden Messverfahren an, um Körperfunktionen des Menschen zu beschreiben und zu bewerten. Sie können Anwendungsbeispiele und Beispiele der Interpretation benennen - kennen Einflussgrößen, die die Interpretation von Ergebnissen aus Messverfahren beeinflussen sowie Grenzen von Messverfahren - lernen die protokollgeführte Durchführung von Untersuchungen und die standardisierte Dokumentation dieser Ergebnisse **Sozialkompetenzen** Die Studierenden:
- erfahren durch regelhafte Rollenwechsel - sie übernehmen sowohl die Rolle des Probanden wie auch die der Versuchsleitung - einen wertschätzenden Umgang miteinander.
- lernen Anwendungsbeispiele aus dem klinischen Alltag die zur Gewährleistung einer Patientensicherheit
notwendigen standardisierten Abläufe **Selbstkompetenzen** Die Studierenden:
- setzen sich mit der Funktion, der Leistungsfähigkeit des eigenen Körpers auseinander aber auch mit dessen Grenzen - setzen sich mit dem Lebenszyklus von Zeugung, Geburt, Adoleszenz, Erwachsenen- und Altersszeit

Module contents
**Vorlesungen:**
- Räumliche Orientierung (am Skelett) - Eschreiben muskulärer Bewegungsabläufe - EKG ableiten und auswerten - Spirometrie - Ultraschalluntersuchungen - Histologie / Mikroskopie - Labormedizin - Gynäkologie - Standardisierte Einleitung einer Narkose am Phantom

Literaturempfehlungen
- Speckmann / Wittkowski, Handbuch Anatomie, h.f. ullmann publishing GmbH 2015, ISBN 978-3-8480-0878-0

Links
https://www.uni-oldenburg.de/versorgungsforschung/abteilungen/medizininformatik/lehre/

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Reference text
Die Durchführung der Veranstaltung erfolgt in Kooperation mit verschiedenen Professuren der Departments.
Für Humanmedizin, sowie der Anatomie der Fakultät VI.

Modullevel / module level
AS (Akzentsetzung / Accentuation)

Modulart / type 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
Am Ende der Vorlesungszeit / Anfang des Folgesemesters
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Präsenzzeit Modul insgesamt 56 h
inf852 - IT Project Management

Module label | IT Project Management
Modulkürzel | inf852
Credit points | 6.0 KP
Workload | 180 h

Verwendbarkeit des Moduls

- Bachelor's Programme Biology (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Business Administration and Law (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Business Informatics (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Chemistry (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Comparative and European Law (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Computing Science (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Economics and Business Administration (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Bachelor's Programme Education (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Engineering Physics (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Environmental Science (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Mathematics (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Physics (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Social Studies (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Bachelor's Programme Sustainability Economics (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Biology (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme General Education (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme History (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Praxismodule für Studierende mit außerschulischem Berufsziel
Zuständige Personen

Sauer, Jürgen (Prüfungsberechtigt)

Lehrenden, Die im Modul (Prüfungsberechtigt)

Sauer, Jürgen (Module responsibility)

Prerequisites

Skills to be acquired in this module

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

Professional competence

The students:

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

Methodological competence

The students:

- Perform projects with the tools of each phase

Social competence

The students:

- Work in small project-teams
- Make design decisions cooperatively
- Present solutions

Self-competence

The students:

- Acquire DP-Project-Management methods and use them
- Recognise and are responsible for working packages

Module contents

It is important to know different IT project management types and forms as well as corresponding methods and tools. This course provides basic data-processing problems, activities and methods. The course is based on M. Burghardt's book. After an introduction, the course is divided as follows:

- Project management (Requirements Engineering, Profitability Analysis, Organisational Structure)
- Project Planning (Project Structure, Network Analysis, Project Plans)
- Project Control (Cost Evaluation, Quality Control)
- Project Completion

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

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<td>Links</td>
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**Vorkenntnisse / Previous knowledge**

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| Präsenzzeit Modul insgesamt | 56 h  |

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341 / 373
### inf950 - Interdisciplinary Module I

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#### Prerequisites

#### Skills to be acquired in this module

**Ziele des Moduls/Kompetenzen:**
Die Absolventinnen und Absolventen kennen die Grundlagen und anwendungsrelevanten Hintergründe der ausgewählten Disziplin.

**Fachkompetenzen**
Die Studierenden:

- benennen die Grundlagen und Methoden des gewählten Gebietes
- wenden die Fachsprache des Anwendungsgebietes kompetent an

**Methodenkompetenzen**
Die Studierenden:

- charakterisieren Nutzungskontext und Anforderungen von IT im gewählten Gebiet
- wenden die disziplinären Methoden und Techniken des Anwendungsgebietes an und kontrastieren diese mit den aus der Informatik bekannten Methoden und Techniken
- untersuchen Probleme eines Anwendungsgebietes mit den disziplin-typischen Methoden

**Sozialkompetenzen**
Die Studierenden:

- können die Verschiedenheit von Fachkulturen einschätzen und respektieren andere Fachgebiete und deren Arbeitsweise
- bereiten sich auf Anwendungsszenarien für IT-Systeme vor

**Selbstkompetenzen**
Die Studierenden:

- reflektieren ihr Selbstbild und Handeln vor dem Hintergrund einer anderen Fachdisziplin

#### Module contents

Das Modul wird mit Fachmodulen aus anderen Disziplinen oder Modulen des Departments für Informatik instanziert, die als Nicht Informatik-Modul gekennzeichnet sind. Die Veranstaltungsformen und Prüfungsmodalitäten orientieren sich an dem jeweils gewählten Modul.

**Literaturempfehlungen**

**Links**

**Languages of instruction**

**Duration (semesters)**

1 Semester

**Module frequency**

**Module capacity**

unlimited

**Modulart / typ of module**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

**Examination**

Prüfungszeiten

**Type of examination**

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**Form of instruction**

VA-Auswahl

**SWS**

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**Module Information**

- **Credit Points**: 6.0 KP
- **Workload**: 180 h
- **Verwendbarkeit des Moduls**: Master's Programme Computing Science (Master) > Nicht Informatik
- **Zuständige Personen**: 
- **Module Frequency**: 1 Semester
- **Module Capacity**: Unlimited
- **Module Level**: BC (Basiscurriculum / Base curriculum)
- **Module Art**: Je nach Studiengang Pflicht oder Wahlpflicht
- **Examination**: Final exam of module
- **Form of Instruction**: VA-Auswahl
- **SWS**: 2
- **Frequency**: WiSe
- **Workload Präsenzzzeit**: 28 h
wir021 - Double Entry Bookkeeping & Financial Statements under German Law (HGB)

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Business Administration and Law (Bachelor) > Basiscurriculum
- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum - Pflichtbereich
- Bachelor's Programme Economics and Business Administration (Bachelor) > Basismodule
- Bachelor's Programme Mathematics (Bachelor) > Nebenfachmodule
- Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Basismodule
- Master's Programme Computing Science (Master) > Nicht Informatik

**Zuständige Personen**
Lehrenden, Die im Modul (Prüfungsberechtigt)
Hombach, Katharina (Module responsibility)

**Prerequisites**
none

**Skills to be acquired in this module**
- Participants...
1. understand financial accounting as the basis of corporate data and bookkeeping
2. gain comprehensive knowledge of main accounting areas such as procurement, sales, HR, inventory, tax, provisions etc.
3. obtain basic knowledge about annual report process of single entities.

**Module contents**
The main objective of this module is to give the students an overview of the double entry bookkeeping as well as the link between financial accounting, balance sheet and income statement. The acquisition of basis knowledge of the corporate accountancy stands in the foreground, for example, how organizations manage the bookkeeping, legal basis of the annual accounts, creating an inventory, content of accounting and income statement.

**Literaturempfehlungen**

An additional script is provided.

**Links**
http://www.uni-oldenburg.de/accounting/

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Modulart / module level**
BC (Basiscurriculum / Base curriculum)

**Lehr-/Lernform / Teaching/Learning method**
je nach Studiengang Pflicht oder Wahlpflicht

**Vorkenntnisse / Previous knowledge**
Grundfertigkeiten im Umgang mit Gesetzestexten

**Examination**
Prüfungszeiten
- Type of examination
- Final exam of module
  - at the end of the semester
  - final exam

**Form of instruction**
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**Präsenzzeit Modul insgesamt**
56 h
wir082 - Corporate Finance

Module label
Corporate Finance

Modulkürzel
wir082

Credit points
6.0 KP

Workload
180 h

Verwendbarkeit des Moduls

- Bachelor's Programme Business Administration and Law (Bachelor) > Aufbaubereich Wirtschaftswissenschaften
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Wirtschaftswissenschaften
- Bachelor's Programme Economics and Business Administration (Bachelor) > Akzentsetzungsmodule
- Bachelor's Programme Mathematics (Bachelor) > Nebenfachmodule
- Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich more...
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Aufbaumodule
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Schwerpunkt Management und Ökonomie
- Master of Education Programme (Vocational and Business Education) Economics and Business Administration (Master of Education) > Mastermodule
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen
Prokop, Jörg (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites
Skills to be acquired in this module

- Students
  - understand the role corporate finance plays in today’s business environment,
  - are able to make consistent investment decisions based on established financial models both under certainty and under uncertainty,
  - are able to place these models in within the broader context of economic theory, including both neoclassical theory and principal-agent theory,
  - are able to assess the limitations of these models,
  - analyze firm’s main sources of (long-term) financing.

Module contents
Course outline:
1. Introduction
2. Valuation and Capital Budgeting
3. Risk and Return
4. Long-Term Financing

This course is an introduction to corporate finance. It covers typical tools and techniques used in making investment and financing decisions, and it provides insights into their theoretical foundations. The concept of time value of money and net present value is discussed in detail, first under certainty, and then in the presence of uncertainty. We will examine the relationship between an investment's risk and its return, and discuss ways to derive risk-adjusted cost of equity capital. In addition, the course provides insights into firms’ main sources of (long-term) financing.

The topics covered in this course are relevant for financial decision-making in various areas of business management, including operations management, marketing, and in particular corporate strategy.

Literaturempfehlungen
Main textbook:
Hiller, Ross, Westerfield, Jaffe & Jordan, Corporate Finance, current edition, McGraw-Hill (especially chapters 1, 2, 4-10, 14).

Supplementary readings:
Berk & DeMarzo, Corporate Finance, current edition, Boston (Mass.).
Brealey, Myers & Allen, Principles of Corporate Finance, current edition, Boston (Mass.).

Links
http://www.uni-oldenburg.de/fiwi_bbl/

Language of instruction
English

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
### Previous Knowledge

- Financial Accounting (wir060)
- Statistik I (wir150)
- Managerial Accounting (wir032)
- Einführung in die VWL (wir041)
- Mikroökonomische Theorie (wir120)

### Examination

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**Präsenzzeit Modul insgesamt**: 56 h
wir160 - Entrepreneurship

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**Verwendbarkeit des Moduls**
- Bachelor's Programme Business Administration and Law (Bachelor) > Aufbaubereich Wirtschaftswissenschaften
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Wirtschaftswissenschaften
- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Bachelor's Programme Computing Science (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Betriebswirtschaftslehre
- Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich
- Master of Education Programme (Vocational and Business Education) Economics and Business Administration (Master of Education) > Mastermodule
- 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)
Nicolai, Alexander (Module responsibility)

**Prerequisites**
none

**Skills to be acquired in this module**
The module introduces to the basics of Entrepreneurship
Upon completion of the module, students will be able to:
- understand the challenges of launching an enterprise,
- strategically analyse the structure of market
- understand how employees are able to behave like an entrepreneur in established enterprises
- develop innovative business ideas
- shape the key factors for realizing a business idea
- demonstrate a knowledge of the entrepreneurial process
- demonstrate a knowledge of cost accounting (especially break-even analysis, etc.) and will be able to calculate costs by themselves
- analyse and evaluate business models

**Module contents**
The module combines the lecture “Strategie und Entrepreneurship” with a tutorial. It investigates the challenges of launching enterprises and entrepreneurial behaviour in large companies as well. The content of the module follows the process of an entrepreneur. It starts with business ideas, their perception, and evaluation. In addition, it deals with the most important questions of development and management of new business models. The contents of the courses include the following topics:
- historical, institutional, and theoretical context
- development, evaluation, and pitching ideas
- business models
- building entrepreneurial teams
- entrepreneurship in large enterprises
- resources and finance
- management of growth

**Literaturempfehlungen**

**Links**
http://www.uni-oldenburg.de/wire/entrepreneurship/lehrangebot/veranstaltungen/lehrangebot-wise-20162017/

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited
The lecture “Strategie und Entrepreneurship” must be attended in combination with the “Tutorium”.

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**wir210 - Corporate Environmental Management**

**Module label**: Corporate Environmental Management  
**Modulkürzel**: wir210  
**Credit points**: 6.0 KP  
**Workload**: 180 h

**Verwendbarkeit des Moduls**

- Bachelor's Programme Business Administration and Law (Bachelor) > Aufbaubereich Wirtschaftswissenschaften  
- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Wirtschaftswissenschaften  
- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft  
- Bachelor's Programme Computing Science (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft  
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Betriebswirtschaftslehre more...  
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Ökologie und Nachhaltigkeit  
- Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich  
- Master of Education Programme (Vocational and Business Education) Economics and Business Administration (Master of Education) > Mastermodule  
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)  
- Master's Programme Computing Science (Master) > Nicht Informatik

**Zuständige Personen**

Siebenhüner, Bernd (Module responsibility)  
Lehrenden, Die im Modul (Module counselling)

**Prerequisites**

**Skills to be acquired in this module**

- understand the goals and concepts of sustainable development;  
- discuss the importance of sustainability for companies;  
- know basic strategies and instruments that enable companies to achieve sustainable development;  
- acquire conceptual and practical skills using case studies, in particular about which instruments can be used to prepare companies for the challenges of sustainable development.

**Module contents**

The module consists of a lecture and a seminar. While the lecture presents and explains concepts, instruments and strategies for sustainable development, the seminar focuses on the practical relevance of the various instruments, concepts and strategies and discusses these based on case studies.  
- Concepts and goals of sustainable development  
- Introduction to the current discussion on sustainable development  
- Current sustainability instruments and strategies for companies  
- Case studies

**Literaturempfehlungen**


**Links**

https://www.uni-oldenburg.de/wire/

**Language of instruction**: German  
**Duration (semesters)**: 1 Semester  
**Module frequency**: jährlich  
**Module capacity**: unlimited  
**Modulelevel / module level**: je nach Studiengang Pflicht oder Wahlpflicht  
**Lehr-/Lernform / Teaching/Learning method**: Vorlesung mit begleitendem Seminar  
**Vorkenntnisse / Previous knowledge**
### Examination

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**Präsenzzeit Modul insgesamt** 56 h
### wir270 - Resource and Energy Economics

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<td></td>
<td>Ressourcen- und energiekonomische Standardmodelle nachzu vollziehen,</td>
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<tr>
<td></td>
<td>Standardmodelle in Hinblick auf weitergehende Fragestellungen anzupassen bzw. zu erweitern,</td>
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<tr>
<td></td>
<td>die Funktionsweise von Ressourcen- und Energimärkten zu verstehen,</td>
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<td>reale Vorgänge auf Ressourcen- und Energimärkten anhand der Kriterien Effizienz, Verteilung und Nachhaltigkeit zu bewerten,</td>
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<td>die institutionell-regulatorischen Rahmenbedingungen von Ressourcen- und Energimärkten anhand der Kriterien Effizienz, Verteilung und Nachhaltigkeit zu bewerten.</td>
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<td>Behandelt werden die Themenlinien nicht regenerierbare Ressourcen (effiziente Nutzung, intertemporale Gerechtigkeit, intertemporales Marktgleichgewicht); regenerierbare Ressourcen (effiziente Nutzung im steady state, Marktgleichgewicht); Nachhaltigkeit; Grundlagen der Energiewirtschaft; Energiennachfrage; Energie und Umwelt; Energieressourcen; Märkte für Primärenergieträger; Strommarkt und Regulierung. Dabei stehen die volkswirtschaftlichen Aspekte im Zentrum, wobei notwendigerweise auch grundlegende technische und betriebswirtschaftliche Aspekte vermittelt werden.</td>
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<td>Links</td>
<td><a href="https://www.uni-oldenburg.de/wire/">https://www.uni-oldenburg.de/wire/</a></td>
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### wir360 - Environmental and Sustainability Policies

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| Verwendbarkeit des Moduls | - Bachelor's Programme Business Informatics (Bachelor) > Akzentrsetzungsbereich Wirtschaftswissenschaften  
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Ökologie und Nachhaltigkeit  
- Bachelor's Programme Sustainability Economics (Bachelor) > Vertiefungsmodul  
- Master's Programme Computing Science (Master) > Nicht Informatik |
| Zuständige Personen       | Lehrende, Die im Modul (Prüfungsberechtigt)  
Siebenhüner, Bernd (Module counselling)  
Siebenhüner, Bernd (Module responsibility) |
| Prerequisites             | none                                      |
| Skills to be acquired in this module | students:  
- have basic information about national and European environmental and sustainability governance  
- describe the history of national and European environmental and sustainability governance  
- reflect upon central principles, instruments, players and strategies in environmental and sustainability governance |
| Module contents           | Development directions of German and European environmental and sustainability governance;  
Analysis of selected topics like energy, agriculture, chemical industry etc.;  
Principles of environmental and sustainability governance;  
Instruments of environmental and sustainability governance compared on international level;  
New mechanisms in governance;  
Relevant actors of environmental and sustainability governance (administration, industry, media, science, NGOs etc.);  
International environmental and sustainability governance |
| Links                      | https://www.uni-oldenburg.de/wire/         |
| Language of instruction   | German                                    |
| Duration (semesters)      | 1 Semester                                |
| Module frequency          | yearly                                    |
| Module capacity           | unlimited                                 |
| Modulelevel / module level | SPM (Schwerpunktmodule / Main emphasis)   |
| Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht |
| Lehr-/Lernform / Teaching/Learning method |                                      |
| Vorkenntnisse / Previous knowledge |                                      |
| Examination               | Prüfungszeiten                           |
| Type of examination       | presentation                             |
| Final exam of module      | presentation                             |
| Form of instruction       | Comment                                  |
| SWS                       | Frequency                                |
| Workload of compulsory   | attendance                               |
| Lecture                   | 2                                        |
| Seminar                   | 2                                        |
| Präsenzzeit Modul insgesamt | 56 h                                     |
**wir806 - Information Technology Law**

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**Verwendbarkeit des Moduls**

- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Bachelor's Programme Computing Science (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Master Applied Economics and Data Science (Master) > Specialization
- 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) > Recht und Gesellschaft more...
- Master's Programme Business Administration, Economics and Law (Master) > Basismodule
- Master's Programme Business Administration, Economics and Law (Master) > Mantelmodule (MPC2020)
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule RdW - Recht
- 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)

**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

**Modullevel / module level**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

Vorkenntnisse / Previous knowledge

**Examination**

Prüfungszeiten | Type of examination
--- | ---
during term | presentation and handout, written exam or oral exam

**Final exam of module**

**Form of instruction** | Comment | SWS | Frequency | Workload of compulsory attendance
--- | --- | --- | --- | ---
Lecture | | 2 | | 28
Seminar | | 2 | | 28

Präsenzzeit Modul insgesamt | | | | 56 h
**wir808 - Multivariate Statistics**

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**Verwendbarkeit des Moduls**
- Master's Programme Business Administration, Economics and Law (Master) > Basismodule
- Master's Programme Business Administration, Economics and Law (Master) > Mantelmodule (MPO2020)
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "Volkswirtschaftslehre" (VWL) (MPO2020)
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Environmental Modelling (Master) > Mastermodule
- Master's Programme Sustainability Economics and Management (Master) > Basic and Accentuation Modules

**Zuständige Personen**
- Stecking, Ralf Werner (Module responsibility)
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
- Lehrenden, Die im Modul (Prüfungsberechtigt)

**Skills to be acquired in this module**
- With successful completion of the course, students shall:
  - be aware of and be able to evaluate advanced methods of multivariate data analysis.
  - be able to select adequate methods in relevant fields of application, like prediction, classification, and segmentation analysis.
  - be able to run computer-aided analyses and to interpret the results properly.

**Module contents**
- Various methods of quantitative data analysis such as:
  - Linear Regression,
  - Logistic Regression,
  - Linear Discriminant Analysis,
  - Principal Component Analysis,
  - Feature selection and evaluation methods.

**Literaturempfehlungen**

**Links**
- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
- Modullevel / module level: MM-PB (Professionalisierungsbereichsmodul im Master)
- Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht

**Vorkenntnisse / Previous knowledge**

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**Präsenzzeit Modul insgesamt**: 56 h
**wir812 - Environmental Law**

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**Verwendbarkeit des Moduls**
- Master's Programme Business Administration, Economics and Law (Master) > Basismodule
- Master's Programme Business Administration, Economics and Law (Master) > Mantelmodule (MP02020)
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule NM-Recht
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule RdW - Recht
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Sustainability Economics and Management (Master) > Basic and Accentuation Modules

**Zuständige Personen**
- Meyerholt, Ulrich (Module counselling)
- Godt, Christine (Module responsibility)
- Lehrende, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
Building on the existing knowledge of the participants, the course will deepen knowledge of European and international law, whereby emphasis will be laid on those areas in which the dividing line between state intervention (public law) and market rights (private law) has become blurred. Students will be able to analyze contemporary regulatory techniques inherent in the multilevel system of governance and to assess them from an interdisciplinary (economic and legal) perspective.

**Module contents**
The module comprises two courses, one of which will be taught by PD Dr. Meyerholt, and the other together with Prof. Godt.
The first course deals with selected issues in environmental law. With the general structure of environmental law as a point of departure, the course content will be taught in a holistic manner that will also incorporate the leading decisions of the higher courts.
The second course takes into consideration intra-disciplinary environmental law as situated between public and private economic law, whereby special focus will be laid on the European and international dimensions.

**Literaturempfehlungen**

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Modullevel / module level**
---

**Modulart / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

**Form of instruction**
Lecture

**SWS**
4

**Frequency**
SoSe oder WiSe

**Workload Präsenzzeit**
56 h
wir814 - Strategic Management

Module label: Strategic Management

Modulkürzel: wir814

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Business Administration, Economics and Law (Master) > Mantelmodule (MPO2020)
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "China - Wirtschaft und Sprache" (CHI) - Kerne (MPO2020)
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule RdW - BWL
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule UF - BWL
- Master's Programme Business Administration, Economics and Law (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik

Zuständige Personen:
Hoppmann, Jörn (Module responsibility)

Lehrenden, Die im Modul (Prüfungsberechtigt):

Prerequisites:
Keine

Skills to be acquired in this module:
Students...
- Know advanced theoretical concepts, research streams, and frameworks of in the field of Strategic Management
- Understand the links between different theories and are able to critically question them
- Can apply theories to understand and interpret organizational dynamics in daily life
- Are able to develop solutions for concrete practical challenges in companies in the context of Strategic Management based on the concepts and frameworks they have learned
- Can put the newly acquired knowledge into a broader context, so it can be deepened in the further professional life

Module contents:
The course offers an overview of advanced concepts and frameworks in the field of Strategic Management. At the beginning, the course will provide a brief introduction into the historical development, goals, and research streams of the field. In this context, important terms, methods, and philosophical approaches of (management) research will be clarified. Subsequently, students form groups to analyze selected scientific articles with regard to their theoretical relevance and practical implications. Theoretical topics that will be covered in depth are:

1. Top Management Teams, Upper Echelons and Corporate Governance
2. Resource- and Capability-based Approaches
4. Institutional Theory, Institutional Work/Entrepreneurship and Social Movements
5. Organizational Cognition, Identity, and Framing
6. Organizational Learning and Ambidexterity
7. Organizational networks and ecosystems

The results of the analysis will be summarized in a seminar thesis, presented in class, and discussed with the other students. The main goal of the course is to equip students with advanced concepts, which allow them to understand organizational dynamics, question established practices in firms, and develop new solutions that go beyond the application of standard instruments.

Literaturempfehlungen:

Links
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**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

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**Form of instruction**

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Präsenzzeit Modul insgesamt 56 h
### wir857 - Law of Media and Telecommunication

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#### Verwendbarkeit des Moduls
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule RdW - Recht
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule UF - Recht
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "Recht der Wirtschaft" (MPC2020)
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik

#### Zuständige Personen
Boehme-Neßler, Volker (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

#### Prerequisites
The students:
- have in-depth insights into the economic conditions of media production, distribution and exploitation.
- know the legal basis and framework conditions of media production, media presentation and mediation (e.g. copyrights, performance rights, distribution of media).
- bring together economic and legal dimensions of media work.
- know the economic and legal framework conditions of media institutions (e.g. television, radio, media mediation).

#### Module contents
This module is about making a connection of the theoretical and practical acquired aesthetic competences with the economic and legal framework conditions. In the sense of professionalisation, prospective media producers and mediators should learn to assess their own future activities under economic and legal conditions.

#### Literaturempfehlungen
- Current case law and:
  - Fechner, Medienrecht, 19.Aufl. 2018
  - Petersen, Medienrecht, 2010.
- http://www.integrated-media.de/

#### Links
- German
- 1 Semester
- jährlich
- unlimited
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- je nach Studiengang Pflicht oder Wahlpflicht

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

#### Vorkenntnisse / Previous knowledge
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#### Form of instruction
- Lecture

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<th>Frequency</th>
<th>Workload Präsenzzeit</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>SoSe</td>
<td>56 h</td>
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</tbody>
</table>
## Module: Data Protection Law

**Module label**: Data Protection Law  
**Modulkürzel**: wir860  
**Credit points**: 6.0 KP  
**Workload**: 180 h  

### Verwendbarkeit des Moduls
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule RdW - Recht  
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule UF - Recht  
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "Recht der Wirtschaft" (RdW) (MPC2020)  
- 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)  
- Rott, Peter (Module responsibility)

### Prerequisites
**Skills to be acquired in this module**
- Upon completion of the module, students will be able to:
  - recognize simple data protection incidents.  
  - apply existing protection mechanisms.  
  - implement projects in accordance with the law.  
  - discuss and defend their plans in front of others.

### Module contents
- The module gives an overview on data protection laws. Basic knowledge of data protection regulations (DSGVO; BDSG) and existing protection mechanisms is imparted. Within the framework of the seminar, the discussed topics will be deepened with the help of seminar papers and individual aspects will be discussed in more detail.
- The event will highlight the new informational structures in modern society and their effects on data protection and data security. Questions concerning general personal rights, freedom of information, IT security and relevant criminal law regulations will be discussed on the basis of examples and legally provided protection mechanisms as well as the tasks of supervisory authorities will be discussed. In particular, the most important decisions on data protection will be covered in detail during the seminar.
- At the seminar, students will have the opportunity to prepare in-depth seminar papers on the various topics, which will then be discussed with all participants.

### Literatureempfehlungen
- Further literature references will be given in the lecture.

### Links

### Language of instruction
- German

### Duration (semesters)
- 1 Semester

### Module frequency
- jährlich

### Module capacity
- unlimited

### Modullevel / module level
- ---

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

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

### Vorkenntnisse / Previous knowledge

### Examination
- **Prüfungszeiten**
- **Type of examination**
  - Seminar paper and presentation or Term paper or Oral exam

### Final exam of module
- **typically 6 weeks after your presentation**

### Form of instruction
<table>
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<tr>
<td>Seminar</td>
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361 / 373
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<td>56 h</td>
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</table>
**wir875 - Forecasting Methods**

**Module label**
Forecasting Methods

**Modulkürzel**
wir875

**Credit points**
6.0 KP

**Workload**
180 h

**Verwendbarkeit des Moduls**
- Master Applied Economics and Data Science (Master) > Empirical Methods
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule UF - VWL
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "Volkswirtschaftslehre" (VWL) (MPO2020)
- Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)
- Master's Programme Computing Science (Master) > Nicht Informatik

**Zuständige Personen**
Stecking, Ralf Werner (Module responsibility)
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Prerequisites**
Lehrenden, Die im Modul (Prüfungsberechtigt)

**Skills to be acquired in this module**
With successful completion of the course, students shall:
- be aware of and be able to evaluate quantitative forecasting methods.
- be able to select adequate methods in relevant fields of application, like time series and classification analysis.
- be able to run computer-aided analyses and to interpret the results properly.

**Module contents**
Various aspects of quantitative forecasting methods such as:
- Time series components,
- Trend and seasonal methods,
- Stationarity,
- Multivariate forecasting methods,
- Autoregressive and moving average processes,
- Box-Jenkins method.

**Literaturempfehlungen**
Thome, H. (2005): Zeitreihenanalyse, München

**Links**

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
halbjährlich

**Module capacity**
unlimited

**Modullevel / module level**
---

**Modularl / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning**
method

Vorkenntnisse / Previous knowledge

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<tr>
<td>Final exam of module</td>
<td>end of semester</td>
<td>written exam or oral exam or term paper or seminar paper and presentation</td>
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<td>Exercises</td>
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<td>28</td>
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<td>56 h</td>
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</tbody>
</table>
### wir901 - Environmental Economics

**Module label**: Environmental Economics  
**Modulkürzel**: wir901  
**Credit points**: 6.0 KP  
**Workload**: 180 h  
\[
\begin{align*}
\text{Lecture:} & \quad 3 \text{ SWS (42h)} \\
\text{Exercise:} & \quad 1 \text{ SWS (14h)}
\end{align*}
\]

**Verwendbarkeit des Moduls**
- Master Applied Economics and Data Science (Master) > Economics
- Master’s Programme Business Administration, Economics and Law (Master) > Schwerpunktmodule NM-VWL
- Master's Programme Business Administration, Economics and Law (Master) > Schwerpunkt "Volkswirtschaftslehre" (VWL) (MPO2020)
- Master’s Programme Computing Science (Master) > Nicht Informatik
- Master’s Programme Environmental Modelling (Master) > Mastermodule
- Master’s Programme Sustainability Economics and Management (Master) > Basic and Accentuation Modules

**Zuständige Personen**
- Helm, Carsten (Module counselling)
- Lehrenden, Die im Modul (Module counselling)
- Lehrenden, Die im Modul (Prüfungsberechtigt)
- Helm, Carsten (Module responsibility)

**Prerequisites**
- Keine

**Skills to be acquired in this module**
- Know and be able to apply fundamental concepts and figures of thought in environmental economics; be able to analyse and evaluate environmental problems and solution approaches; practice scientific methods and the ability to discuss; be able to classify environmental economics in the context of interdisciplinary sustainability research.

**Module contents**
- Economic analysis of environmental impacts (property rights, external effects, market failure); ethical aspects of environmental economics, instruments of environmental policy (tradable permits, taxes, subsidies, liability law); innovation and adaptation of new technologies; international environmental problems.

**Literaturempfehlungen**

**Links**
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: Annually
- Module capacity: unlimited
- Modullevel / module level: je nach Studiengang Pflicht oder Wahlpflicht
- Lehr-/Lernform / Teaching/Learning method: Vorlesung und Übung / Lecture and exercise

**Vorkenntnisse / Previous knowledge**

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<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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<tbody>
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<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>Written exam; bonus through solution of exercises</td>
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**Form of instruction**

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**Frequency**

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**Workload of compulsory attendance**

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<th>Exercises</th>
<th>Präsenzzeit Modul insgesamt</th>
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<tbody>
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<td>28</td>
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<td>56 h</td>
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</table>
wir904 - Environmental and Sustainability Policies

<table>
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<td>wir904</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
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| Verwendbarkeit des Moduls           | Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master)  
|                                    | Master's Programme Computing Science (Master) > Nicht Informatik  
|                                    | Master's Programme Sustainability Economics and Management (Master) > Basic and Accentuation Modules |
| Zuständige Personen                | Lehrenden, Die im Modul (Prüfungsberechtigt)  
|                                    | Siebenhüner, Bernd (Module counselling)  
|                                    | Wegner, Alkje (Module counselling)  
|                                    | Müller, Werner Joachim (Module counselling)  
|                                    | Siebenhüner, Bernd (Module responsibility) |

Prerequisites

Skills to be acquired in this module

- have basic information about national and european environmental and sustainability governance  
- describe the history of national and european environmental and sustainability governance  
- reflect upon central principles, instruments, players and strategies in environmental and sustainability governance  
- analyze selected topics of environmental and sustainability governance based upon central principles, instruments, players and strategies

Module contents

- Introduction to environmental politics - Politics, Political Science, Policy Analysis  
- Environment – Terms and Concepts - Historical Foundations of Environmental Politics  
- Actors, institutions and governance structures; Actors in Environmental Policy  
- Socio-ecological systems framework  
- Environmental Policy in Germany  
- Environmental Policy in the European Union  
- Steering and principles in environmental policy  
- Instruments in environmental policy  
- Policy process and environmental policy  
- Multilevel and reflexive governance - Multilevel governance  
- International environmental governance  
- Science-Policy Interface

Literaturempfehlungen

Aden, Hartmut (2012): Umweltpolitik, Wiesbaden: VS-Verlag  

Links

https://www.uni-oldenburg.de/wire/

Languages of instruction

German, English

Duration (semesters)

1 Semester

Module frequency

halbjährlich

Module capacity

unlimited

Modullevel / module level

BM (Basismodul / Base)

Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method


Vorkenntnisse / Previous knowledge
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</table>
**wir905 - Environmental Sciences**

**Module label**  
Environmental Sciences

**Modulkürzel**  
wir905

**Credit points**  
6.0 KP

**Workload**  
180 h

**Verwendbarkeit des Moduls**
- Master's Programme Computing Science (Master) > Nicht Informatik
- Master's Programme Sustainability Economics and Management (Master) > Basic and Accentuation Modules
- Master's Programme Water and Coastal Management (Master) > Science

**Zuständige Personen**
- Freund, Holger (Module counselling)
- Köster, Jürgen (Module counselling)
- Dozent, Gast (Module counselling)
- Klenke, Thomas (Prüfungsberechtigt)
- Freund, Holger (Prüfungsberechtigt)
- Köster, Jürgen (Prüfungsberechtigt)
- Klenke, Thomas (Module responsibility)

**Prerequisites**
The introduction to processes and systems of the dynamic Earth constituting the foundation for sustainable management is presented to produce:
- Knowledge about processes and systems relevant for sustainable management using knowledge and methodologies from all science disciplines in an integrated way.
- Skills in elaborating on complex tasks of environmental management using an interdisciplinary science based approach and to present related findings to non-expert audiences.
- Lecture room presentations and discussions based on slides and black/white board usage.

Short films will be presented to endorse the intended achievements.

**Module contents**
Lecture: Understanding the Bioplanet Earth (2 contact hours/week) (Vorlesung, 2 LVS: Aufbau und Entwicklungsgeschichte der Erde; Dynamik der Erde: Kreisläufe und Evolutionsprozesse; Lebensraum Boden; Wasser; Klima; Biodiversität; Lagerstätten und Ressourcenerschließung; Ökosysteme der Erde.)

Seminar: Cases in Understanding the Bioplanet Earth (2 contact hours/week)

Introduction to key processes and to systems dynamics of the Earth representing a planet being alive driven by external and internal forces interacting with biological activities. Topics of the lecture comprise introductions to the evolution of the universe and solar systems, the differentiation and sub-systems of the Earth’s interior, minerals and rock cycle, soils, ocean and climate, evolution and biodiversity, organisms and physiology, water and element cycling plus insights into ecosystems under different climate conditions. The cases are selected in order to (i) highlight certain principles and theories in geo- and biosciences and (ii) exemplify critical objects and phenomena in modern practice of resource and environmental management.

This module consists of topical programmes of the Master Cluster Environment and Sustainability.

**Literaturempfehlungen**
A 'foundation material pool' will be made available online for students and lecturers providing paper books, reports and media covering the topics of the lecture and the cases.

**Links**
- **Language of instruction**: English
- **Duration (semesters)**: 1 Semester
- **Module frequency**: jährlich
- **Module capacity**: unlimited
- **Modullevel / module level**: BM (Basismodul / Base)
- **Modulart / typ of module**: Pflicht / Mandatory

**Vorkenntnisse / Previous knowledge**
- **Examination**: Prüfungszeiten
  - **Type of examination**: Presentation/discussion and written report on a case;
    - Scientific quality of presentation (40 %)
    - Clarity of presentation and discussion (20 %)
    - Scientific quality of report (40 %)

- **Final exam of module**: By the end of the lecture period.
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<th>Workload of compulsory attendance</th>
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<tr>
<td>Lecture</td>
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<td>Seminar</td>
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</table>
Renewable Energy Systems

Module label: Renewable Energy Systems
Modulkürzel: wir915
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master’s Programme Computing Science (Master) > Nicht Informatik
- Master’s Programme Sustainability Economics and Management (Master) > Additional Modules

Zuständige Personen:
- Peinke, Joachim (Prüfungsberechtigt)
- Knecht, Robin (Prüfungsberechtigt)
- Hölling, Michael (Prüfungsberechtigt)
- Golba, Michael (Prüfungsberechtigt)
- Torio, Herena (Prüfungsberechtigt)
- Holtorf, Hans-Gerhard (Prüfungsberechtigt)
- Peinke, Joachim (Module responsibility)
- Siebenhüner, Bernd (Module responsibility)
- Hölling, Michael (Module responsibility)

Prerequisites:
None.

Skills to be acquired in this module:
Students learn details about the wide range of renewable energy sources and renewable energy technology as well as their background story.

Module contents:
Energy basics, energy resources, global energy overview, energy scenarios, techno-economic aspects of energy use (external costs, life cycle analysis,...), environmental effects of energy use (greenhouse gas emissions, ozone,...), conventional and advanced power plant technologies, power distribution, advanced storage technologies, solar thermal power plants, geothermal and ocean energies.

Literaturempfehlungen:

Links:
Languages of instruction: German, English
Duration (semesters): 1 Semester

Module frequency: halbjährlich
Module capacity: unlimited
Modullevel / module level: MM-PB (Professionalisierungsbeirichtsmodul im Master)
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:
  - By the end of the lecture period.
  - Term paper or written exam.
Form of instruction: Seminar

SWS:
Frequency:
Workload Präsenzzeit: 0 h
Abschlussmodul

mam - Master Thesis and Colloquium

<table>
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<th>Master Thesis and Colloquium</th>
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<td>Modulkürzel</td>
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<tr>
<td>Credit points</td>
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<td>Workload</td>
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<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Computing Science (Master) &gt; Abschlussmodul</td>
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<tr>
<td>Zuständige Personen</td>
<td>Sonnenschein, Michael (Module responsibility)</td>
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<td>Hein, Andreas (Module responsibility)</td>
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<td>Lehrenden, Die im Modul (Module counselling)</td>
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</table>

Prerequisites

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 hypotheses to theories independently
- Work in their field independently

| Module contents | Independently researched scientific work. The research findings will be presented and discussed in a master’s thesis colloquium. |
| Literatureempfehlungen | ist entsprechend des konkreten Themas selbst zu recherchieren |
| Links |  |
| Languages of instruction | German, English |
| Duration (semesters) | 1 Semester |
| Module frequency | halbjährlich |
| Module capacity | unlimited |
| Modullevel / module level | Abschlussmodul (Abschlussmodul) |
| Modulart / typ of module | Pflicht |
| Lehr-/Lernform / Teaching/Learning method | S (2 SWS) MA+S |
| Vorkenntnisse / Previous knowledge |  |
| Examination | Prüfungszeiten | Type of examination |
| Final exam of module | Individuell in Absprache mit den GutachterInnen und BetreuerInnen | Master’s thesis, presentation and discussion. |
| Form of instruction | Seminar |  |
| SWS | 2 |  |
| Frequency | SoSe und WiSe |  |
| Workload Präsenzzeit | 28 h |