Modules for Computing Science

Kernmodule
inf900 - Group Project

Module label
Group Project

Module code
inf900

Credit points
24.0 KP

Workload
720 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Kernmodule
- Master Informatik > Kernmodule
- Master Wirtschaftsinformatik > Kernmodule

Contact person
Module responsibility
- Die im Modul Lehrenden

Authorized examiners
- Die im Modul Lehrenden

Entry requirements
Skills to be acquired in this module
The students 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.

Reader's advisory
According to the assigned task
<table>
<thead>
<tr>
<th>Links</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Languages of instruction</td>
<td>German, English</td>
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<tr>
<td>Duration (semesters)</td>
<td>2 Semester</td>
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<tr>
<td>Module frequency</td>
<td>semi-anual</td>
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<tr>
<td>Module capacity</td>
<td>unlimited</td>
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<tr>
<td>Modullevel</td>
<td>AS (Akzentsetzung / Accentuation)</td>
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<tr>
<td>Modulart</td>
<td>Pflicht o. Wahlpflicht / compulsory or optional</td>
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<tr>
<td>Lern-/Lehrform / Type of program</td>
<td>PG</td>
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<td>Vorkenntnisse / Previous knowledge</td>
<td>- Programmierkurs</td>
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<td></td>
<td>- Softwareotechnik</td>
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<td></td>
<td>- Soft Skills</td>
</tr>
<tr>
<td>Examination</td>
<td>Time of examination</td>
</tr>
<tr>
<td>Final exam of module</td>
<td>Active involvement, presentation, final report, project assessment</td>
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<td>Course type</td>
<td>Project group</td>
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<td>SWS</td>
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<td>SuSe and WiSe</td>
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Angewandte Informatik

inf131 - Advanced Topics in Human Computer Interaction

<table>
<thead>
<tr>
<th>Module label</th>
<th>Advanced Topics in Human Computer Interaction</th>
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<tbody>
<tr>
<td>Module code</td>
<td>inf131</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<td>Workload</td>
<td>180 h</td>
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Used in course of study
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Informatik > Angewandte Informatik
- Master Informatik > Praktische Informatik

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

Entry requirements
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.

Course prerequisite: Mensch-Maschine-Interaktion (Human Computer Interaction)

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 artifacts

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:
- Be comfortable tackling original research questions
- Aptitude in conceptualizing and running both qualitative and quantitative HCI experiments
- 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.

Structure of the Module:

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.

Lectures: 2 hours per week
Lab: 2 hours per week

This lecture will be held in English. All assignment submissions and exams will be in English.

The primary audience for this class are Master students of Computer Science following the Human Computer Interaction track.

Reader's advisory

Suggested reading:


Links

Language of instruction English
Duration (semesters) 1 Semester
Module frequency semi-annual
Module capacity 24
Modullevel AS (Akzentsetzung / Accentuation)
Modulart Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program V+P
Vorkenntnisse / Previous knowledge Interaktive Systeme

Examination

Time of examination At the end of the lecture period
Type of examination Project and oral exams

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:

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<tr>
<th>Scored Items</th>
<th>%</th>
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<tr>
<td>Final</td>
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<tr>
<td>Assignments A01-03</td>
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<tr>
<td>Mini HCI research project</td>
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<th>Comment</th>
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<td>SuSe or WiSe</td>
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**Total time of attendance for the module** 56 h
inf303 - Fuzzy Control and Artificial Neural Networks in Robotics and Automation

Module label
Fuzzy Control and Artificial Neural Networks in Robotics and Automation

Module code
inf303

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Engineering Physics > Schwerpunkt: Renewable Energies
- Master Informatik > Angewandte Informatik
- Master Informatik > Technische Informatik

Contact person

Module responsibility
- Sergej Fatikow
- Die im Modul Lehrenden

Authorized examiners
- Sergej Fatikow
- Die im Modul Lehrenden

Entry requirements

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

**Reader's advisory**

**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.: 2000
- Schulte, U.: Einführung in Fuzzy-Logik, Franzis-Verlag, München, 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**

- German, English

**Duration (semesters)**

- 1 Semester

**Module frequency**

- once a year

**Module capacity**

- unlimited

**Modullevel**

- AS (Akzentsetzung / Accentuation)

**Modulart**

- Pflicht o. Wahlpflicht / compulsory or optional

**Vorkenntnisse / Previous knowledge**

- Control engineering

**Examination**

<table>
<thead>
<tr>
<th>Time of examination</th>
<th>Type of examination</th>
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<tr>
<td>At the end of the lecture period until the beginning of the next semester</td>
<td>Hands-on-exercises and oral Exam</td>
</tr>
<tr>
<td>Course type</td>
<td>Comment</td>
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<td>-------------</td>
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<td>Lecture</td>
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<td>Exercises</td>
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**Total time of attendance for the module** 56 h
inf500 - Modelling and Simulation of Ecological Systems

Module label: Modelling and Simulation of Ecological Systems
Module code: inf500
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik

Contact person:
Module responsibility:
- Ute Vogel-Sonnenschein
- Die im Modul Lehrenden

Authorized examiners:
- Ute Vogel-Sonnenschein
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:

Professional competence:
The students:
- name general discrete and continuous modeling methods and space-based model designs
- explain elementary concepts of ecological systems
- characterise typical qualities as well as advantages and disadvantages of different modelling methods for ecological systems and evaluate them
- appropriately apply modelling concepts for ecological systems
- describe basic simulation methods, in particular for discrete models, and put them into practice

Methodological competence:
The students:
- use basicsimulation methods for discrete models
- systematically learn about new simulation tools in a short time
- implement simple ecological models

Social competence:
The students:
- solve tasks in teams of 2-3 students

Self-competence:
The students:
- reflect their actions considering simulation methods

Module contents:
Methods of modelling and simulation enable a detailed understanding of interdependencies in dynamic systems. In the field of ecology there are numerous methodical approaches, for example cause-effect graphs, differential equations, Markov models, L-Systems, cellular automata or individual-oriented models. These approaches are exemplary introduced by the lecture and are illustrated by exemplary core concepts of ecological systems. These modelling methods are accompanied by simulation procedures.

Software tools were and are being developed for the use of such methods. Those tools are exemplarily discussed regarding their construction and functionality. Tools for mathematical model simulations as well as individual-oriented simulations are introduced and are used in exercises.

The interpretation of simulation results leads to model validation and to a discussion on the forecast quality of models.

The module "inf500 Modellbildung in Simulation ökologischer Systeme" is accompanied by the module "inf501 Environmental Information Systems", which focuses on persistent storage of spatial information as well as concepts of data analysis. Nevertheless, the modules can be taken independently from each other.

Reader's advisory:
Essential:
- Lecture notes (are available in the lecture)

Secondary literature:
• Hartmut Bossel. Modellbildung und Simulation. Vieweg 1994

**Links**

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>German</th>
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<tbody>
<tr>
<td>Duration (semesters)</td>
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<td>Module frequency</td>
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<td>Module capacity</td>
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</table>

**Reference text**

- inf501 Umweltinformationssysteme

**Modullevel**

AS (Akzentsetzung / Accentuation)

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

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

**Vorkenntnisse / Previous knowledge**

**Final exam of module**

At the end of the lecture period

**Type of examination**

- Oral exam

**Course type**

<table>
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<th>Lecture</th>
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<td>14 h</td>
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**Total time of attendance for the module**

56 h
inf501 - Environmental Information Systems

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<tr>
<td></td>
<td>Master Sustainability Economics and Management &gt; Ergänzungsmodul</td>
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<td>Master Umweltmodellierung &gt; Mastermodule</td>
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<td>Master Wirtschaftsinformatik &gt; Bereichswahlmodule</td>
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<td>Contact person</td>
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<td></td>
<td>Ute Vogel-Sonnenschein</td>
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<tr>
<td>Entry requirements</td>
<td>Skills to be acquired in this module</td>
</tr>
<tr>
<td></td>
<td>The module gives an overview of the phases and important aspects of the environmental information processing.</td>
</tr>
<tr>
<td>Professional competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>apply basic processing algorithms to classify and process data</td>
</tr>
<tr>
<td></td>
<td>compare, evaluate and design data structures to store spatial data efficiently</td>
</tr>
<tr>
<td></td>
<td>apply basic functions of a geo-information system</td>
</tr>
<tr>
<td></td>
<td>describe, evaluate and apply basic processes of data mining</td>
</tr>
<tr>
<td></td>
<td>describe, evaluate and apply basic geostatistics processes</td>
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<tr>
<td></td>
<td>evaluate and apply multicriteria decision making processes</td>
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<tr>
<td>Methodological competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>use geoinformation systems for environmental appplication</td>
</tr>
<tr>
<td></td>
<td>use data mining tools for data analysis</td>
</tr>
<tr>
<td>Social competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>solve tasks in teams of 2-3 students</td>
</tr>
<tr>
<td></td>
<td>present and discuss their solutions in class</td>
</tr>
<tr>
<td>Self-competence</td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>reflect their own behaviour with regard to the methods of environmental informatics</td>
</tr>
</tbody>
</table>

**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.

**Reader's advisory**  

**Links**

<table>
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<th>Language of instruction</th>
<th>German</th>
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<tbody>
<tr>
<td>Duration (semesters)</td>
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<td>Module capacity</td>
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**Reference text**  
Associated with the module:

- Inf500 Modellbildg. und Sim. ökol. Systeme

**Module level**  
AS (Akzentsetzung / Accentuation)

**Modulart**  
je nach Studiengang Pflicht oder Wahlpflicht

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

| Vorkenntnisse / Previous knowledge | - Informationssysteme I  
- Grundlagen der Statistik |

<table>
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<th>Time of examination</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
<td>Second and third week after the end of the lecture period - retake before the upcoming lecture period</td>
<td>Oral exam</td>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>3.00</td>
<td>SuSe</td>
<td>42 h</td>
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<td>Exercises</td>
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<td>1.00</td>
<td>SuSe</td>
<td>14 h</td>
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**Total time of attendance for the module**  
56 h
**inf502 - Simulation**

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<th>Simulation</th>
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<td>Credit points</td>
<td>6.0 KP</td>
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<td>Workload</td>
<td>180 h</td>
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<td>Master Informatik &gt; Angewandte Informatik</td>
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<td></td>
<td>Master Wirtschaftsinformatik &gt; Bereichswahlmodule</td>
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<td></td>
<td>Axel Hahn</td>
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<td>Jürgen Sauer</td>
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<td>Axel Hahn</td>
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<td>Jürgen Sauer</td>
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**Entry requirements**

**Skills to be acquired in this module**

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.

**Reader's advisory**


**Links**

<table>
<thead>
<tr>
<th>Languages of instruction</th>
<th>German, English</th>
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<tbody>
<tr>
<td>Duration (semesters)</td>
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<td>Modullevel</td>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>students need to have programming skills. Java is preferred.</td>
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inf510 - Energy Information Systems

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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
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| Used in course of study | Master Engineering Physics > Schwerpunkt: Renewable Energies  
                         Master Informatik > Angewandte Informatik  
                         Master Umweltmodellierung > Mastermodule  
                         Master Wirtschaftsinformatik > Bereichswahlmodule |
| Contact person | Module responsibility  
                         » Sebastian Lehnhoff  
                         » Die im Modul Lehrende |
| Authorized examiners | » Sebastian Lehnhoff  
                         » Die im Modul Lehrende |
| Entry requirements | Skills to be acquired in this module  
                         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 |
### Reader's advisory

- Crastan V.: "Elektrische Energieversorgung II", Springer 2004
- Schwab, A.: "Elektroenergiesysteme, Springer 2009"

### Links

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### Lern-/Lehrform / Type of program

**Vorkenntnisse / Previous knowledge**

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<td>Final exam of module</td>
<td>At the end of the semester</td>
<td>Student research project or presentation</td>
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### Course type

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### Total time of attendance for the module

56 h
inf511 - Smart Grid Management

Module label: Smart Grid Management
Module code: inf511
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Engineering Physics > Schwerpunkt: Renewable Energies
- Master Informatik > Angewandte Informatik
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person:
Module responsibility:
- Sebastian Lehnhoff
- Die im Modul Lehrenden

Authorized examiners:
- Sebastian Lehnhoff
- Die im Modul Lehrenden

Entry requirements:
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)

Reader's advisory
Suggested reading:

- Crastan V.: "Elektrische Energieversorgung II", Springer 2004

Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge
Examination
Time of examination: At the end of the semester
Type of examination: Oral exam

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**inf513 - Energy Informatics Practical**

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<tr>
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<tr>
<td>Workload</td>
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| Used in course of study | - Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul  
                        | - Master Informatik > Angewandte Informatik  
                        | - Master Wirtschaftsinformatik > Bereichswahlmodule |
| Contact person        | Module responsibility  
                        | o Andreas Hein  
                        | o Jorge Marx Gomez  
                        | o Sebastian Lehnhoff  
                        | o Die im Modul Lehrenden |
| Authorized examiners  | o Andreas Hein  
                        | o Jorge Marx Gomez  
                        | o Sebastian Lehnhoff  
                        | o Die im Modul Lehrenden |
| Entry requirements    | Programming with JAVA |
| 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

**Module contents**

In this practical course students:

- 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, convergancy, quality) on the training,
- learn the foundations for choice and design of simulation based experiments.

**Reader’s advisory**

**Suggested reading:**

**Smart Grids:**


**Multiagentensysteme:**


**Co-Simulation**


**Versuchsplanung:**


**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

**Modullevel**

AS (Akzentsetzung / Accentuation)

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

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

**Vorkenntnisse / Previous knowledge**

- Programmierung mit Java
- Programmierung mit Python

**Examination**

**Time of examination**

Type of examination

**Final exam of module**

At the end of the semester

Oral exam
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inf520 - Management of Information Systems in Health Care

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<td>• Master Wirtschaftsinformatik &gt; Bereichswahlmodule</td>
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<td>Module responsibility</td>
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<tr>
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<td>Rainer Röhrig</td>
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<td>Rainer Röhrig</td>
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Entry requirements

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<th>Professional competence</th>
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<tbody>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• know healthcare information systems and their functions</td>
</tr>
<tr>
<td></td>
<td>• know clinical software architectures and apply their IT strategies</td>
</tr>
<tr>
<td></td>
<td>• know and apply system integration standards, methods (including medical technology) and risk management</td>
</tr>
<tr>
<td></td>
<td>• know and apply clinical information systems and maintain them</td>
</tr>
<tr>
<td></td>
<td>• know the legal and regulatory framework (including data privacy) for the operation of healthcare IT systems</td>
</tr>
<tr>
<td></td>
<td>• implement simple data analyses on care data</td>
</tr>
<tr>
<td></td>
<td>• know and apply procurement processes and changes</td>
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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

Reader's advisory

Links

Language of instruction  German

Duration (semesters)  1 Semester
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<td>- Informationssysteme / Datenbanken</td>
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inf522 - Information Processing in Bio-Medical Research

Module label: Information Processing in Bio-Medical Research

Module code: inf522

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Angewandte Informatik

Contact person:

Module responsibility:
- Rainer Röhrig
- Die im Modul Lehrenden

Authorized examiners:
- Die im Modul Lehrenden
- Rainer Röhrig

Entry requirements:
The students are aware of the requirements of biomedical research information processing and technologies. They know, develop and evaluate approaches.

Skills to be acquired in this module:

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>
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<tbody>
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| Total time of attendance for the module | 56 h |

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25 / 297
inf523 - Medical Software Engineering

Module label: Medical Software Engineering
Module code: inf523
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Angewandte Informatik

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

Entry requirements:
- Skills to be acquired in this module:
  - Professional competence:
    - 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:
    - 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:
    - 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:
    - 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.

Reader's advisory:

Links:
- Languages of instruction: German, English
- Duration (semesters): 1 Semester
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<td><strong>Vorkenntnisse / Previous knowledge</strong></td>
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inf524 - Introduction to Medicine for Computer Science Students

Module label: Introduction to Medicine for Computer Science Students
Module code: inf524
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Informatik > Nicht Informatik

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

Authorized examiners:
- Rainer Röhrig
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module

Module contents

Reader's advisory

Links

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

Module frequency

Module capacity: unlimited

Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination

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

Total time of attendance for the module: 56 h
inf533 - Probabilistic Modelling I

Module label          Probabilistic Modelling I
Module code          inf533
Credit points        3.0 KP
Workload             90 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person
Module responsibility
- Claus Möbus
- Die im Modul Lehrenden

Authorized examiners
- Claus Möbus
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
Recent eBooks, eTutorials

Links
http://www.uni-oldenburg.de/en/computingscience/lcs/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
AS (Akzentsetzung / Accentuation)
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inf534 - Probabilistic Modelling II

Module label: Probabilistic Modelling II
Module code: inf534
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodulle
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person:
Module responsibility:
- Claus Möbus
- Die im Modul Lehrenden

Authorized examiners:
- Claus Möbus
- Die im Modul Lehrenden

Entry requirements:
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

Reader's advisory:
Recent publications

Links:
http://www.uni-oldenburg.de/en/computingscience/ics/probabilistic-programming/

Language of instruction:
German

Duration (semesters):
1 Semester

Module frequency:
halbjährlich

Module capacity:
unlimited

Reference text:
Associated with the module:
- inf533 Probabilistische Modellierung I

Module level:
AS (Akzentsetzung / Accentuation)
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inf535 - Computational Intelligence I

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<td>Workload</td>
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**Used in course of study**
- Master Informatik > Angewandte Informatik
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik

**Contact person**
- Module responsibility
  - Oliver Kramer
  - Die im Modul Lehrenden

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

**Entry requirements**

**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-modelling

**Reader's advisory**
Links
Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | jährlich
Module capacity | unlimited
Modullevel | AS (Akzentsetzung / Accentuation)
Modulart | je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge | - Grundlagen der Statistik
Examination | Time of examination | Type of examination
Final exam of module | At the end of the lecture period | Written or oral exam
Course type | Comment | SWS | Frequency | Workload attendance
Lecture | | 2.00 | WiSe | 28 h
Exercises | | 2.00 | WiSe | 28 h
Total time of attendance for the module | 56 h
inf536 - Computational Intelligence II

Module label: Computational Intelligence II
Module code: inf536
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Informatik > Angewandte Informatik
- Master Umweltmodellierung > Mastermodule

Contact person:
Module responsibility

- Oliver Kramer

Authorized examiners

- Die im Modul Lehrenden
- Oliver Kramer

Entry requirements:

Skills to be acquired in this module:

Professional competence
The students:

- Recognise machine learning problems
- Implement simple algorithms of machine learning
- 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 w.r.t. peers
- Realise personal limitations
- Adapt own problem solving approaches w.r.t. required method competences

Module contents:

Computational Intelligence comprises intelligent and adaptive methods for optimisation and learning. The module "Computational Intelligence II" concentrates on methods for machine learning and data mining. The exercises introduce and deepen practical aspects of the implementation and algorithmic design, also taking into account application aspects.

Overview of Content:

- Foundations of learning and classification
- Nearest neighbouring methods
- Model selection and parameter tuning
- Regression
- Support vector and kernel methods
- Clustering
- Dimensionality reduction

Reader's advisory:

- HASTIE, T., TIBSHIRANI, R., FRIEDMAN, J.H.: The Elements of Statistical Learning, Springer 2009
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**inf537 - Intelligent Systems**

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**Contact person**

Module responsibility
- Jürgen Sauer
- Die im Modul Lehrenden

Authorized examiners
- Jürgen Sauer
- Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**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
- Agent systems and
- 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.

**Reader's advisory**

Suggested reading:
- Ghallab/ Nau/Traverso: Automated Planning, Morgan Kaufman, 2004

**Links**

**Languages of instruction**

German, English
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<th>Duration (semesters)</th>
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inf538 - Adaptive Computing

**Module label**
Adaptive Computing

**Module code**
inf538

**Credit points**
6.0 KP

**Workload**
180 h

**Used in course of study**
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik

**Contact person**

**Module responsibility**
- Jorge Marx Gomez
- Jürgen Sauer
- Die im Modul Lehrenden

**Authorized examiners**
- Jorge Marx Gomez
- Jürgen Sauer
- Die im Modul Lehrenden

**Entry requirements**

**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 organizational 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 Adaptive 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, performance indicators
- SOA, EAI
- Controlling tools, Monitoring
- Solutions: SAP Adaptive Computing

Reader's advisory

Suggested reading:
- current company data
- current materials from internet
- 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
Modullevel  AS (Akzentsetzung / Accentuation)
Modulart  je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Previous knowledge

Examination  Time of examination  Type of examination
Final exam of module  at the end of the semester  Portfolio
!

Course type  Comment  SWS  Frequency  Workload attendance
Vorlesung und Seminar  2.00  SuSe  28 h
Exercises  2.00  SuSe  28 h

Total time of attendance for the module  56 h
inf584 - Special Topics in 'Energy Informatics' I

Module label: Special Topics in 'Energy Informatics' I
Module code: inf584
Credit points: 6.0 KP
Workload: 180 h

Used in course of study: Master Informatik > Angewandte Informatik

Contact person:
Module responsibility
- Sebastian Lehnhoff
- Die im Modul Lehrenden

Authorized examiners
- Sebastian Lehnhoff
- Die im Modul Lehrenden

Entry requirements
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

Reader's advisory:
As announced in course

Links:
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program: 2 courses out of V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge:
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<th>Type of examination</th>
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## inf585 - Special Topics in 'Energy Informatics' II

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

### Entry requirements
**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

### Reader’s advisory
As announced in course

### Links

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inf586 - Current Topics in 'Energy Informatics' I

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**Used in course of study**
- Master Informatik > Angewandte Informatik

**Contact person**
- Module responsibility
  - Sebastian Lehnhoff
  - Die im Modul Lehrenden

**Entry requirements**

**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

**Reader’s advisory**
- As announced in course

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- unregelmäßig

**Module capacity**
- unlimited

**Modullevel**
- AS (Akzentsetzung / Accentuation)

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

**Lern-/Lehrform / Type of program**
- S or V

**Vorkenntnisse / Previous knowledge**

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inf587 - Current Topics in 'Energy Informatics' II

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**Contact person**

- Sebastian Lehnhoff
- Die im Modul Lehrenden

**Entry requirements**

**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

**Reader's advisory**

As announced in course

**Links**

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modullevel: AS (Akzentsetzung / Accentuation)
- Modulart: je nach Studiengang Pflicht oder Wahlpflicht
- Lern-/Lehrform / Type of program: S or V
- Vorkenntnisse / Previous knowledge
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inf588 - Special Topics in 'Medical Informatics'' I

Module label
Special Topics in 'Medical Informatics'' I

Module code
inf588

Credit points
6.0 KP

Workload
180 h

Used in course of study
• Master Informatik > Angewandte Informatik

Contact person
Module responsibility
• Andreas Hein
• Die im Modul Lehrenden

Authorized examiners
• Andreas Hein
• Die im Modul Lehrenden

Entry requirements

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. „Medizinische Bildverarbeitung“ or „Standard und Systeme für die Kommunikation in der Medizin“

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge
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inf589 - Spezielle Themen aus dem Gebiet "IT im Gesundheitswesen" II

Module label
Spezielle Themen aus dem Gebiet "IT im Gesundheitswesen" II

Module code
inf589

Credit points
6.0 KP

Workload
180 h

Used in course of study
• Master Informatik > Angewandte Informatik

Contact person
Module responsibility
• Andreas Hein
• Die im Modul Lehrenden

Authorized examiners
• Andreas Hein
• Die im Modul Lehrenden

Entry requirements

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. „Medizinische Bildverarbeitung“ or „Standard und Systeme für
die Kommunikation in der Medizin“

Reader's advisory
As announced in the according course

Links
Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge
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inf590 - Current Topics in 'Medical Informatics' I

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

**Entry requirements**

**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

**Reader's advisory**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modullevel**

AS (Akzentsetzung / Accentuation)

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

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

S oder V

**Vorkenntnisse / Previous knowledge**
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inf591 - Aktuelle Themen aus dem Gebiet "IT im Gesundheitswesen" II

Module label: Aktuelle Themen aus dem Gebiet "IT im Gesundheitswesen" II
Module code: inf591
Credit points: 3.0 KP
Workload: 90 h

Used in course of study: Master Informatik > Angewandte Informatik

Contact person:
- Andreas Hein
- Rainer Röhrig
- Die im Modul Lehrenden

Authorized examiners:
- Andreas Hein
- Rainer Röhrig
- Die im Modul Lehrenden

Entry requirements:

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

Reader's advisory:
As announced in course

Links:

Language of instruction:
German

Duration (semesters):
1 Semester

Module frequency:
unregelmäßig

Module capacity:
unlimited

Modullevel:
AS (Akzentsetzung / Accentuation)

Modulart:
je nach Studiengang Pflicht oder Wahlpflicht
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### Module label
Current Topics in 'Learning and Cognitive Systems' I

### Module code
inf594

### Credit points
3.0 KP

### Workload
90 h

### Used in course of study
- Master Informatik > Angewandte Informatik

### Contact person

**Module responsibility**
- Claus Möbus
- Die im Modul Lehrenden

**Authorized examiners**
- Claus Möbus
- Die im Modul Lehrenden

### Entry requirements
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“

### Reader's advisory
As announced in course

### Links

#### Language of instruction
German

#### Duration (semesters)
1 Semester

#### Module frequency
unregelmäßig

#### Module capacity
unlimited

#### Modullevel
AS (Akzentsetzung / Accentuation)

#### Modulart
je nach Studiengang Pflicht oder Wahlpflicht

#### Lern-/Lehrform / Type of program
S or V

#### Vorkenntnisse / Previous knowledge

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inf595 - Current Topics in 'Learning and Cognitive Systems' II

Module label
Current Topics in 'Learning and Cognitive Systems' II

Module code
inf595

Credit points
3.0 KP

Workload
90 h

Used in course of study
- Master Informatik > Angewandte Informatik

Contact person

Module responsibility
- Claus Möbus
- Die im Modul Lehrenden

Authorized examiners
- Claus Möbus
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program
S or V

Vorkenntnisse / Previous knowledge
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inf596 - Spezielle Themen aus dem Gebiet "Computational Intelligence" I

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Contact person
Module responsibility
- Oliver Kramer
- Die im Modul Lehrenden

Authorized examiners
- Oliver Kramer
- Die im Modul Lehrenden

Entry requirements
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. „Medizinische Bildverarbeitung“ or „Standard und Systeme für die Kommunikation in der Medizin“

Reader's advisory
As announced in the according course

Links

Language of instruction | German
Duration (semesters)   | 1 Semester
Module frequency        | unregelmäßig
Module capacity         | unlimited
Modullevel              | AS (Akzentsetzung / Accentuation)
Modulart                | je nach Studiengang Pflicht oder Wahlpflicht
Lern-Lehrform / Type of program | 2 courses out of V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge
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- **Course type**: Course selection
- **SWS**: 2.00
- **Frequency**: WiSe
- **Workload attendance**: 28 h
inf597 - Spezielle Themen aus dem Gebiet "Computational Intelligence" II

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Contact person
- Module responsibility
  - Oliver Kramer
  - Die im Modul Lehrenden

Authorized examiners
- Oliver Kramer
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge
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inf598 - Current Topics in 'Computational Intelligence' I

Module label
Current Topics in 'Computational Intelligence' I

Module code
inf598

Credit points
3.0 KP

Workload
90 h

Used in course of study
- Master Informatik > Angewandte Informatik

Contact person
Module responsibility
- Oliver Kramer
- Die im Modul Lehrenden

Authorized examiners
- Oliver Kramer
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links
Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
S or V

Vorkenntnisse / Previous knowledge
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**Contact person**

- Module responsibility
  - Oliver Kramer
  - Die im Modul Lehrenden
- Authorized examiners
  - Oliver Kramer
  - Die im Modul Lehrenden

**Entry requirements**

**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“

**Reader's advisory**

As announced in course

**Links**

- **Language of instruction**
  - German
- **Duration (semesters)**
  - 1 Semester
- **Module frequency**
  - unregelmäßig
- **Module capacity**
  - unlimited
- **Modullevel**
  - AS (Akzentsetzung / Accentuation)
- **Modulart**
  - je nach Studiengang Pflicht oder Wahlpflicht
- **Lern-/Lehrform / Type of program**
  - S oder V
- **Vorkenntnisse / Previous knowledge**
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### inf604 - Business Intelligence I

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  - Master Informatik > Angewandte Informatik  
  - Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule  
  - Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik  
| Contact person     | Module responsibility          |
|                    | - Jorge Marx Gomez             |
|                    | Authorized examiners           |
|                    | - Jorge Marx Gomez             |
|                    | - Die im Modul Lehrenden       |

#### Entry requirements

**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 past 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 processes 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
• Prospects for further and evolving topics for business intelligence (e.g. Adaptive Business Intelligence, In-Memory Computing, etc.).
• Introduction to Data Mining.
• Case studies based practical exercises and assessments in order to impart practical knowledge.

Reader's advisory

• Adamson (2010): The complete reference star schema.
• Marx Gómez, Rautenstrauch, Cissek (2008): Einführung in die Business Intelligence mit SAP NetWeaver 7.0.
• Müller, Lenz (2013): Business Intelligence.

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

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
V+Ü

Vorkenntnisse / Previous knowledge

Examination
Time of examination
Written exam max. 120 minutes

Final exam of module
At the end of the lecture period

Course type
Comment
SWS
Frequency
Workload attendance

Lecture

2.00
WiSe
28 h

Exercises

2.00
WiSe
28 h

Total time of attendance for the module
56 h

WiSe
inf607 - Business Intelligence II

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<tr>
<td>Entry requirements</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>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.</td>
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<tr>
<td>Professional competence</td>
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<tr>
<td>The students:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>name and recognize the role of data analytics / data science as past of a daily business process in a particular company</td>
</tr>
<tr>
<td></td>
<td>able to organize from management perspective data analysis project</td>
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<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>obtain theoretical knowledge about data collection and modelling processes, including state of the art approaches and available best practices</td>
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<tr>
<td>Methodological competence</td>
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<tr>
<td>The students:</td>
<td></td>
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<tr>
<td></td>
<td>being able to execute typical tasks of data analysis, and also being able to proceed deeper with respect to different approaches and methods</td>
</tr>
<tr>
<td></td>
<td>gain a hands on experience and being able to understand advantages and disadvantages of different methods and being able to use obtained knowledge</td>
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<td>Social competence</td>
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<tr>
<td>The students:</td>
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<tr>
<td></td>
<td>build solutions based on case studies given to the group, for example design of regression model based on provided dataset</td>
</tr>
<tr>
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<td>discuss solutions on a technical level</td>
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<td>present obtained case studies solutions as part of the exercises</td>
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<tr>
<td>Self-competence</td>
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<tr>
<td>The students:</td>
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</tr>
<tr>
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<td>critically review provided offered information</td>
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</table>

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.

Reader's advisory

- 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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<tr>
<th><strong>Links</strong></th>
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### Previous knowledge

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**Total time of attendance for the module**: 56 h
inf650 - Transport Systems

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<tr>
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Contact person

- Module responsibility
  - Axel Hahn
  - Die im Modul Lehrenden

- Authorized examiners
  - Axel Hahn
  - Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module

Objective of the module/skills:
The Module Transport systems deals with planning and controlling systems of internal and external company logistics as well as public transport. It provides basic knowledge and recent research topics. The focus is on a resource orientated holistic view of company logistics as well as the planning of transport infrastructure. Furthermore, trends such as autonomous vehicles and intelligent transport systems are discussed.

Professional competence
The students:
- name the basics of planning and controlling company logistics
- assess transport systems of companies
- name methods and approaches of computer aided transport systems and classify them
- characterise software to plan complex logistics

Methodological competence
The students:
- display topics and concepts of transport systems
- simulate transport and its systems with appropriate methods

Social competence
The students:
- work in groups
- discuss their results appropriately

Self-competence
The students:
- realise their limits while working on a project containing aspects of modelling and implementation
- question the presentation of their results

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

Reader's advisory

Suggested reading:

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<th><a href="http://wi-ol.de">http://wi-ol.de</a></th>
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inf651 - Environmental Management Information Systems I

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<td>• Master Sustainability Economics and Management &gt; Ergänzungsmodule</td>
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<td>• Master Umweltmodellierung &gt; Mastermodule</td>
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<td>• Master Wirtschaftsinformatik &gt; Akzentsetzungsmodul Bereich Wirtschaftsinformatik</td>
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<td>• Jorge Marx Gomez</td>
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<td>• Jorge Marx Gomez</td>
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<td>• Die im Modul Lehrenden</td>
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<tr>
<td>Entry requirements</td>
<td>Skills to be acquired in this module</td>
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<tr>
<td></td>
<td>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.</td>
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<tr>
<td></td>
<td>Professional competence</td>
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<td></td>
<td>The students:</td>
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<tr>
<td></td>
<td>• are able to classify and explain the sustainability paradigm</td>
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<td></td>
<td>• are aware of the current status of sustainability reporting</td>
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<tr>
<td></td>
<td>• are able to define and to model material flows</td>
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<tr>
<td></td>
<td>• have obtained know-how in the field of corporate environmental management information systems (CEMIS)</td>
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<td></td>
<td>Methodological competence</td>
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<td>The students:</td>
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<tr>
<td></td>
<td>• implement CEMIS</td>
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<tr>
<td></td>
<td>• apply different techniques and methods to case studies</td>
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<tr>
<td></td>
<td>• develop new case studies in teams</td>
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<td></td>
<td>Social competence</td>
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<td></td>
<td>The students:</td>
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<td></td>
<td>• 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</td>
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<td></td>
<td>• present and discuss their own results with the team and the other members of the course</td>
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<td>Self-competence</td>
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<td></td>
<td>The students:</td>
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<tr>
<td></td>
<td>• learn about their own limitations and learn to accept criticism in order to strengthen their own abilities</td>
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<td></td>
<td>Module contents</td>
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<tr>
<td></td>
<td>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.</td>
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<td>The content in detail:</td>
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<td>• environmental management as a basis for sustainability</td>
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<td>• sustainability and material flow management</td>
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<td>• strategic environmental management</td>
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<td>• eco-controlling life cycle</td>
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<td>• characteristics and system architectures of CEMIS</td>
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<td></td>
<td>• standard software systems</td>
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- environmental accounting systems

**Reader's advisory**


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<th><a href="http://www.wi-ol.de">http://www.wi-ol.de</a></th>
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Inf652 - Production-oriented Business Informatics

Module label: Production-oriented Business Informatics

Module code: inf652

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

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

Authorized examiners:
- Axel Hahn
- Die im Modul Lehrenden

Entry requirements:

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 contextualise 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.

Reader’s advisory:
- 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

**Modullevel**
- AS (Akzentsetzung / Accentuation)

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

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

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<td>Exercises and written exam</td>
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**Total time of attendance for the module**
- 56 h
inf653 - ERP Technologies

Module label: ERP Technologies
Module code: inf653
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

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

Entry requirements

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 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.

Reader’s advisory


**Links**

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**Vorkenntnisse / Previous knowledge**

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**Total time of attendance for the module**

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inf654 - Mobile Commerce

Module label: Mobile Commerce  
Module code: inf654  
Credit points: 6.0 KP  
Workload: 180 h  

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master of Education (Wirtschaftspädagogik) Informatik > Mastermodule
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik

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

Authorized examiners:
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements:

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

Reader's advisory:
- Also all materials provided within the lecture

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

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<td>Written exam</td>
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### Course type

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<tr>
<td>Exercises</td>
<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
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**Total time of attendance for the module** 56 h
inf655 - IT-Controlling

Module label: IT-Controlling
Module code: inf655
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

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

Authorized examiners:
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements:

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 strategical 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 strategical 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 strategical IT-Controlling. The new discipline of IT-Controlling provides plans and methods to avoid isolated applications.

Reader's advisory:
- Gadatsch, A: IT-Controlling: Praxiswissen für IT-Controller und Chief-Information Officer. Springer Verlag, 2012

Links:
http://www.wi-ol.de
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inf657 - Product Engineering

Module label: Product Engineering
Module code: inf657
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik

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

Authorized examiners:
- Axel Hahn
- Die im Modul Lehrenden

Entry requirements

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.

Reader's advisory
-Ehrlenspiel (2003): Integrierte Produktentwicklung
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| **Vorkenntnisse / Previous knowledge** | - Software Engineering (UML / SysML)  
- Kreativitätstechniken  
- Projektmanagement  
- 3D Modellierung |
| **Examination** | **Time of examination** | **Type of examination** |
| **Final exam of module** | At the end of the lecture period | Written exam or oral exam, or written documentation or Presentation or Porfolio |
| **Course type** | **Comment** | **SWS** | **Frequency** | **Workload attendance** |
| Lecture | 2.00 | WiSe | 28 h |
| Exercises | 2.00 | WiSe | 28 h |
| **Total time of attendance for the module** | 56 h |
### Module Contents

The course focuses on:

- Target group oriented stakeholder communication
- Using time efficient approaches to solving problems as well as focusing on key requirements
- How to deal with resource restrictions.

### Reader's Advisory

- Jake Knapp, John Zeratsky, Brand Kowitz (2016): Sprint: How to Solve Big Problems and Test New Ideas in Just 5 Days
- Jeff Patton (2014): User Story Mapping: Discover the Whole Story, Build the Right Product

### Links

http://vlba.wi-ol.de
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inf659 - Environmental Management Information Systems II

Module label  Environmental Management Information Systems II
Module code       inf659
Credit points      6.0 KP
Workload           180 h

Used in course of study
- Master Informatik > Angewandte Informatik
- Master Sustainability Economics and Management > Ergänzungsmodule
- Master Umweltmodellierung > Mastermodule
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik

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

Authorized examiners
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements
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.

Reader's advisory

Hershey (PA), London

- 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  
AS (Akzentsetzung / Accentuation)

Modulart  
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program  
V (2 SWS), Ü (2 SWS) oder SE announced at the beginning of the lecture period (2SWS V + 2 SWS Ü oder block seminar)

Vorkenntnisse / Previous knowledge

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<th>Type of examination</th>
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Total time of attendance for the module  
56 h
**inf660 - ICT in Sustainability Reporting**

**Module label**  
ICT in Sustainability Reporting

**Module code**  
inf660

**Credit points**  
6.0 KP

**Workload**  
180 h  
(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.)

**Used in course of study**
- Master Informatik > Angewandte Informatik  
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik

**Contact person**

**Module responsibility**
- Jorge Marx Gomez  
- Barbara Bremer-Rapp

**Authorized examiners**
- Jorge Marx Gomez  
- Barbara Bremer-Rapp

**Entry requirements**

**Skills to be acquired in this module**

After finishing this course, students should be able to set up a sustainability report tailored 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 tailored 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 tailored 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).
### Reader's advisory


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<th><a href="http://vlba.wi-ol.de">http://vlba.wi-ol.de</a></th>
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inf661 - Digital Transformation

Module label: Digital Transformation
Module code: inf661
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

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

Authorized examiners
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements
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
Reader's advisory


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

Languages of instruction
- German, English

Duration (semesters)
- 1 Semester

Module frequency

Module capacity
- unlimited

Modullevel
- ---

Modulart
- je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

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Course type

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Total time of attendance for the module
- 56 h
### inf663 - Application Area Maritime

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<td>◦ Die im Modul Lehrenden</td>
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#### Entry requirements

**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 to 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 system 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

#### Reader's advisory

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
- Module level: AS (Akzentsetzung / Accentuation)
- Modulart: Pflicht o. Wahlpflicht / compulsory or optional

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**Total time of attendance for the module**: 56 h
inf690 - Special Topics in 'Business Informatics' I

Module label: Special Topics in 'Business Informatics' I
Module code: inf690
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

Contact person:
Module responsibility:
- Axel Hahn
- Jorge Marx Gomez
- Die im Modul Lehrenden

Authorized examiners:
- Axel Hahn
- Jorge Marx Gomez
- Die im Modul Lehrenden

Entry requirements:

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

Reader's advisory:
As announced in course

Links:
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modulelevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
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inf691 - Special Topics in 'Business Informatics' II

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<td>• identify, structure and solve problems/tasks, also in new or developing subject areas</td>
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<td>• apply state of the art and innovative methods to solve problems, if necessary from other disciplines</td>
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<td>• are aware of the current limits and contribute to the development of computer science research and technology</td>
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<td>• discuss and evaluate recent computer science developments</td>
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<td>• evaluate and apply tools, technology and methods sophisticatedly</td>
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inf692 - Special Topics in 'Business Informatics' III

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<td>• Master Wirtschaftsinformatik &gt; Akzentsetzungsmodul Bereich Wirtschaftsinformatik</td>
</tr>
<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>• Jorge Marx Gomez</td>
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<td>• Axel Hahn</td>
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<td>• Jürgen Sauer</td>
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<td></td>
<td>• Die im Modul Lehrenden</td>
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<tr>
<td></td>
<td>Authorized examiners</td>
</tr>
<tr>
<td></td>
<td>• Jorge Marx Gomez</td>
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<td>• Jürgen Sauer</td>
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<tr>
<td></td>
<td>• Die im Modul Lehrenden</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>This module integrates current developments in the field in adequate study courses.</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Professional competences</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• define and contrast a computer science part, in which they are specialised, in detail or evaluate computer science in general</td>
</tr>
<tr>
<td></td>
<td>• recognise and evaluate applied techniques and methods of their subject and are aware of their limits</td>
</tr>
<tr>
<td></td>
<td>• identify, structure and solve problems/tasks, also in new or developing subject areas</td>
</tr>
<tr>
<td></td>
<td>• apply state of the art and innovative methods to solve problems, if necessary from other disciplines</td>
</tr>
<tr>
<td></td>
<td>• are aware of the current limits and contribute to the development of computer science research and technology</td>
</tr>
<tr>
<td></td>
<td>• discuss and evaluate recent computer science developments</td>
</tr>
<tr>
<td></td>
<td>Methodological competences</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• evaluate and apply tools, technology and methods sophisticatedly</td>
</tr>
<tr>
<td></td>
<td>• combine new and original approaches and methods creatively</td>
</tr>
<tr>
<td></td>
<td>• evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research</td>
</tr>
<tr>
<td></td>
<td>Social competences</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• support team process by their abilities</td>
</tr>
<tr>
<td></td>
<td>Self-competences</td>
</tr>
<tr>
<td></td>
<td>The students:</td>
</tr>
<tr>
<td></td>
<td>• pursue the overall and special computer science development critically</td>
</tr>
<tr>
<td></td>
<td>• implement innovative professional activities effectively and independently</td>
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</table>

<table>
<thead>
<tr>
<th>Module contents</th>
<th>See assigned course description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reader's advisory</td>
<td>As announced in course</td>
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<td></td>
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</tr>
<tr>
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inf693 - Special Topics in 'Business Informatics' IV

<table>
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<th>Module label</th>
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<td>Module code</td>
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<td>Credit points</td>
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<td>Workload</td>
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<td>Master Informatik &gt; Angewandte Informatik</td>
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Contact person

Module responsibility
- Jorge Marx Gomez
- Axel Hahn
- Jürgen Sauer
- Die im Modul Lehrenden

Authorized examiners
- Jorge Marx Gomez
- Axel Hahn
- Jürgen Sauer
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)
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<td>Time of examination</td>
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<td>Final exam of module</td>
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inf694 - Current Topics in 'Business Informatics' I

Module label Current Topics in 'Business Informatics' I
Module code inf694
Credit points 3.0 KP
Workload 90 h
Used in course of study
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik
Contact person

Module responsibility
- Jorge Marx Gomez
- Axel Hahn
- Die im Modul Lehrenden

Authorized examiners
- Jorge Marx Gomez
- Axel Hahn
- Die im Modul Lehrenden

Entry requirements

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
Reader's advisory
As announced in course
Links
Language of instruction German
Duration (semesters) 1 Semester
Module frequency unregelmäßig
Module capacity unlimited
Modullevel AS (Akzentsetzung / Accentuation)
Modulart je nach Studiengang Pflicht oder Wahlpflicht
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<td>Examination</td>
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inf695 - Current Topics in 'Business Informatics' II

<table>
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<tr>
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| Used in course of study | • Master Informatik > Angewandte Informatik  
|               | • Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik |
| Contact person| Module responsibility                      |
|              | • Jorge Marx Gomez                         |
|              | • Die im Modul Lehrenden                   |
|              | Authorized examiners                       |
|              | • Jorge Marx Gomez                         |
|              | • Die im Modul Lehrenden                   |

Entry requirements

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

Reader's advisory

As announced in course

Links

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

unregelmäßig

Module capacity

unlimited

Module level

AS (Akzentsetzung / Accentuation)

Modulart

je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

S or V
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<td>Type of examination</td>
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inf696 - Current Topics in 'Business Informatics' III

Module label: Current Topics in 'Business Informatics' III
Module code: inf696
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master Informatik > Angewandte Informatik
- Master Wirtschaftsinformatik > Akzentsetzungsmodul Bereich Wirtschaftsinformatik

Contact person:
Module responsibility:
- Jorge Marx Gomez
- Axel Hahn
- Jürgen Sauer
- Die im Modul Lehrenden

Authorized examiners:
- Jorge Marx Gomez
- Axel Hahn
- Jürgen Sauer
- Die im Modul Lehrenden

Entry requirements:

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
Reader's advisory: As announced in the according course
Links:
- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<td>Examination</td>
<td>Time of examination</td>
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<td>Final exam of module</td>
<td>At the end of the lecture period</td>
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inf697 - Current Topics in 'Business Informatics' IV

<table>
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<tr>
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<tr>
<td>Module code</td>
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<td>3.0 KP</td>
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<td>Workload</td>
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| Used in course of study | - Master Informatik > Angewandte Informatik  
                   | - Master Wirtschaftsinformatik > Akzentsetzungsmodule Bereich Wirtschaftsinformatik |
| Contact person | Module responsibility  
                   | - Jorge Marx Gomez  
                   | - Axel Hahn  
                   | - Jürgen Sauer  
                   | - Die im Modul Lehrenden  
                   | Authorized examiners  
                   | - Jorge Marx Gomez  
                   | - Axel Hahn  
                   | - Jürgen Sauer  
                   | - Die im Modul Lehrenden |
| Entry requirements | 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  
<pre><code>               | - develop and reflect self-developed hypotheses to theories independently |
</code></pre>
<p>| Module contents | See assigned course description |
| Reader's advisory | As announced in the according course |
| Language of instruction | German |
| Duration (semesters) | 1 Semester |
| Module frequency | unregelmäßig |
| Module capacity | unlimited |</p>
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<td>Vorkenntnisse / Previous knowledge</td>
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<td>Examination</td>
<td>Time of examination</td>
</tr>
<tr>
<td>Final exam of module</td>
<td>At the end of the lecture period</td>
</tr>
<tr>
<td>Course type</td>
<td>Course or seminar</td>
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### Technische Informatik

#### inf300 - Hybrid Systems

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<tr>
<th>Module label</th>
<th>Hybrid Systems</th>
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<tr>
<td>Module code</td>
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<td>Workload</td>
<td>180 h</td>
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</table>

**Used in course of study**
- Master Eingebettete Systeme und Mikrorobotik > Akzentsatzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Informatik > Technische Informatik
- Master Informatik > Theoretische Informatik

**Contact person**

- Module responsibility
  - Martin Georg Fränzle
  - Die im Modul Lehrenden
- Authorized examiners
  - Martin Georg Fränzle
  - Die im Modul Lehrenden

**Entry requirements**

**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 tools.

**Reader’s advisory**


**Links**

**Languages of instruction**

- English, German

**Duration (semesters)**

- 1 Semester

**Module frequency**

- once a year

**Module capacity**

- unlimited

**Modullevel**

- AS (Akzentsetzung / Accentuation)

**Modulart**

- Pflicht o. Wahlpflicht / compulsory or optional

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

- V+Ü

**Vorkenntnisse / Previous knowledge**

**Examination**

- Time of examination
- Type of examination

**Final exam of module**

- At the end of the lecture period
- Semester project including written work and final presentation

**Course type**

<table>
<thead>
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<th>Comment</th>
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<td>SuSe</td>
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**Total time of attendance for the module**

- 56 h
inf301 - Machine-oriented Systems Engineering

Module label: Machine-oriented Systems Engineering

Module code: inf301

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Technische Informatik

Contact person

Module responsibility:
- Alfred Mikschl
- Die im Modul Lehrenden

Authorized examiners:
- Alfred Mikschl
- Die im Modul Lehrenden

Entry requirements

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.

Reader's advisory:
Lecturers notes, hardware manuals and data sheets, and development tool manuals

Links:
Languages of instruction: German, English

Duration (semesters): 1 Semester

Module frequency: semi-anual

Module capacity: unlimited

Module level: AS (Akzentsetzung / Accentuation)

Moduleart: Pflicht o. Wahlpflicht / compulsory or optional

Lern-/Lehrform / Type of program: V+P

Vorkenntnisse / Previous knowledge: „Eingebettete Systeme I and II“ and successful completion of the module „Praktikum Technische Informatik“

Examination:
- Time of examination
- Type of examination
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<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>Portfolio (Design, development and implementation of embedded systems, colloquium)</td>
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<th>Comment</th>
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<td>28 h</td>
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<td>Practical</td>
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<td>2.00</td>
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<td>28 h</td>
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**Total time of attendance for the module**: 56 h
inf303 - Fuzzy Control and Artificial Neural Networks in Robotics and Automation

Module label: Fuzzy Control and Artificial Neural Networks in Robotics and Automation
Module code: inf303
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Engineering Physics > Schwerpunkt: Renewable Energies
- Master Informatik > Angewandte Informatik
- Master Informatik > Technische Informatik

Contact person:
Module responsibility:
- Sergej Fatikow
- Die im Modul Lehrenden

Authorized examiners:
- Sergej Fatikow
- Die im Modul Lehrenden

Entry requirements:
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

**Reader's advisory**

**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.: 2000
- Schütte, U.: Einführung in Fuzzy-Logik, Franzis-Verlag, München, 1993
- Zimmermann H.-J. (Hrsg.): Datenanalyse, VDI-Verlag, 1995

**Links**

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<tr>
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<td>Hands-on-exercises and oral Exam</td>
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<td><strong>Total time of attendance for the module</strong></td>
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inf305 - Medical Technology

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

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodulse
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Nicht Informatik
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein

Authorized examiners
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module  Professional competence
The students:
- 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).

Reader’s advisory
essential:
- Lecture slides

recommended:
Links

Languages of instruction  German, English
Duration (semesters)    1 Semester
Module frequency        once a year
Module capacity         unlimited
Module level            AS (Akzentsetzung / Accentuation)
Module art              Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program  V+Ü
Previous knowledge      - Signal and Image Processing
                        - Control Engineering
Examination             Time of examination
                        Final exam of module  At the end of the lecture period
                        Portfolio: Hands-on exercises, report, and written or oral exam
Course type             Comment  SWS  Frequency  Workload attendance
Lecture                 3.00  WiSe  42 h
Exercises               1.00  WiSe  14 h
Total time of attendance for the module  56 h
inf307 - Robotics

Module label  Robotics
Module code  inf307
Credit points  6.0 KP
Workload  180 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Nicht Informatik
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Die im Modul Lehrenden
- Andreas Hein

Entry requirements
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

**Reader's advisory**

**essential:**
- lecture nodes

**recommended:**

**sekondary literature:**

**Links**

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<td>Module frequency</td>
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<td>Module capacity</td>
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**Vorkenntnisse / Previous knowledge**

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<td>Portfolio: Hands-on exercises, report, and written or oral exam</td>
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<th>Workload attendance</th>
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<td>42 h</td>
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<td>Exercises</td>
<td></td>
<td>1.00</td>
<td>SuSe</td>
<td>14 h</td>
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**Total time of attendance for the module**

56 h
inf308 - Microrobotics II

Module label: Microrobotics II
Module code: inf308
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Engineering Physics > Schwerpunkt: Laser und Optik
- Master Informatik > Nicht Informatik
- Master Informatik > Technische Informatik

Contact person:
Module responsibility:
- Sergej Fatikow
- Die im Modul Lehrenden

Authorized examiners:
- Sergej Fatikow
- Die im Modul Lehrenden

Entry requirements:

Skills to be acquired in this module:

After having given an established introduction in the module "Microrobots 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 microrobots

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

Reader's advisory:
- Lecture notes (can be obtained in secretariate, A1-3-303)
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<tr>
<td><strong>Duration (semesters)</strong></td>
<td>1 Semester</td>
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<td><strong>Module frequency</strong></td>
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<td><strong>Module capacity</strong></td>
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<td>V+Ü</td>
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<td><strong>Examination</strong></td>
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<td><strong>Time of examination</strong></td>
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<td><strong>Frequency</strong></td>
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</tr>
<tr>
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<td>42 h</td>
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inf311 - Low Energy System Design

Module label: Low Energy System Design
Module code: inf311
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Technische Informatik

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

Entry requirements:
This module introduces the estimation of power dissipation and optimisation.

Skills to be acquired in this module:

Professional competence
The students:
- Discuss the fundamental problems of power dissipation
- Characterise the requirements-driven design process of embedded systems
- Name power loss analysis and optimization methods
- Design embedded systems with common design and analysis tools
- Design power-optimized embedded systems

Methodological competence
The students:
- Model systems with a hardware description language
- Analyze and model hardware components
- Perform multi-dimensional optimization of systems

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

Self-competence
The students:
- Acknowledge the limits of their ability to cope with pressure during the modeling process of systems

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.

Reader’s advisory:
- 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

Languages of instruction: German, English

Duration (semesters): 1 Semester

Module frequency: jährlich

Module capacity: unlimited

Module level: AS (Akzentsetzung / Accentuation)

Modulart: Pflicht o. Wahlpflicht / compulsory or optional

Lern-/Lehrform / Type of program: V+Ü

Vorkenntnisse / Previous knowledge:
- inf200 Grundlagen der Technische Informatik,
- inf201 Technische Informatik,
- inf203 Eingebettete Systeme I,
- inf204 Eingebettete Systeme II

Examination:
- Time of examination: at the end of the lecture period
- Type of examination: hands-on exercises and oral exam

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

Total time of attendance for the module: 56 h
inf331 - Automated and Connected Driving

Module label: Automated and Connected Driving

Module code: inf331

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Informatik > Technische Informatik

Contact person:

- Module responsibility:
  - Frank Köster
  - Die im Modul Lehrenden

- Authorized examiners:
  - Frank Köster
  - Die im Modul Lehrenden

Entry requirements:

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 driving

**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

Reader's advisory:

Suggested reading:

Links

Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: Once a year
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: Pflicht o. Wahlpflicht / compulsory or optional
Lern- /Lehrform / Type of program: V+Ü
Vorkenntnisse / Previous knowledge:
- inf201 Technische Informatik,
- inf203 Eingebettete Systeme I,
- inf204 Eingebettete Systeme II

Examination

Time of examination: At the end of the lecture period
Type of examination: Praktical work and oral exam

Final exam of module

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

Total time of attendance for the module: 56 h
inf332 - Practice Robotics

Module label: Practice Robotics
Module code: inf332
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Informatik > Technische Informatik

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

Entry requirements:

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.

Reader's advisory:
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: AS (Akzentsetzung / Accentuation)
Modulart: Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program: V+Ü

Vorkenntnisse / Previous knowledge:

Examination:
- Time of examination
- Type of examination
Final exam of module:
- At the end of the lecture period
- Demonstration and written documentation

Course type:
- Lecture

Comment
SWSS
Frequency
Workload attendance
Lecture
2.00
WiSe
28 h
<table>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
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**Total time of attendance for the module**  
56 h
inf333 - Sensor Technology in the Automotive Domain

<table>
<thead>
<tr>
<th>Module label</th>
<th>Sensor Technology in the Automotive Domain</th>
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<tr>
<td>Module code</td>
<td>inf333</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>Used in course of study</td>
<td>Master Engineering of Socio-Technical Systems &gt; Human-Computer Interaction</td>
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<tr>
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<td>Used in course of study</td>
<td>Master Informatik &gt; Technische Informatik</td>
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<tr>
<th>Contact person</th>
<th>Module responsibility</th>
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<tr>
<td></td>
<td>▫ Frank Köster</td>
</tr>
<tr>
<td></td>
<td>▫ Die im Modul Lehrenden</td>
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<table>
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| Entry requirements                   | This module introduces the principles of sensors and sensor-systems as well as data-fusion in the automotive domain. |

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<tr>
<th>Skills to be acquired in this module</th>
<th>Professional competences: The students:</th>
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<tbody>
<tr>
<td></td>
<td>▫ Discuss different levels/diverse levels sensor-technologies</td>
</tr>
<tr>
<td></td>
<td>▫ Discuss sensor-data fusion (multi-level fusion)</td>
</tr>
<tr>
<td></td>
<td>▫ Discuss Kalman-Filter</td>
</tr>
<tr>
<td></td>
<td>▫ Discuss in-vehicle data-processing</td>
</tr>
<tr>
<td></td>
<td>▫ Discuss car2cx-technologies</td>
</tr>
<tr>
<td></td>
<td>▫ Design simple multi-sensor systems</td>
</tr>
<tr>
<td></td>
<td>▫ Evaluate multi-sensor systems</td>
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<table>
<thead>
<tr>
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<th>The students:</th>
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<tr>
<td></td>
<td>▫ Analyze multi-sensor systems</td>
</tr>
<tr>
<td></td>
<td>▫ Design multi-sensor systems</td>
</tr>
<tr>
<td></td>
<td>▫ Evaluate multi-sensor systems</td>
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<table>
<thead>
<tr>
<th>Social competences:</th>
<th>The students:</th>
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<tbody>
<tr>
<td></td>
<td>▫ Work in teams</td>
</tr>
<tr>
<td></td>
<td>▫ Discuss their outcomes appropriately</td>
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<table>
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<tr>
<th>Self-competences:</th>
<th>The students:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>▫ Acknowledge the limits of their ability to cope with pressure during the work on the topics of the module</td>
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<td>Kalman-Filter</td>
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<td></td>
<td>In-vehicle data-processing</td>
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<tr>
<td></td>
<td>Car2cx-technologies (ITS G5 and 5G)</td>
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<td></td>
<td>Multi-sensor and multi-level fusion architectures</td>
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<table>
<thead>
<tr>
<th>Reader's advisory</th>
<th>Suggested reading:</th>
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<td>AS (Akzentsetzung / Accentuation)</td>
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<td>Modulart</td>
<td>Pflicht o. Wahlpflicht / compulsory or optional</td>
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<tr>
<td>Lern-/Lehrform / Type of program</td>
<td>V+Ü</td>
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<th>Vorkenntnisse / Previous knowledge</th>
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<tr>
<td>Examination</td>
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<tr>
<td>Type of examination</td>
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<td>Practikal Work and oral exam</td>
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<td>Exercises</td>
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<td>2.00</td>
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<td>28 h</td>
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| Total time of attendance for the module | 56 h |

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<tr>
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</table>
inf334 - System Level Design

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

Used in course of study:
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Technische Informatik

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

Entry requirements:

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 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.

Reader's advisory

Suggested reading:

Main textbooks:
- D. Gajski, S. Abdi, A. Gerstlauer, G. Schirner, Embedded System Design: Modeling, Synthesis,
- D. C. Black, J. Donovan, B. Bunton, A. Keist, SystemC: From The Ground Up, Second Edition,
  Springer 2010 (“red book”)

Optional books:
- F. Vahid, T. Givargis, Embedded System Design: A Unified Hardware/Software Introduction, Wiley,
  John & Sons, 2001 (“blue book”), Background about embedded systems in general
  2001 (“yellow book”), Practical, example-driven introduction using SpecC

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
AS (Akzentsetzung / Accentuation)

Module type
Pflicht o. Wahlpflicht / compulsory or optional

Lern-/Lehrform / Type of program
V+Ü

Vorkenntnisse / Previous knowledge
- inf200 Grundlagen der Technische Informatik,
- inf201 Technische Informatik,
- inf203 Eingebettete Systeme I,
- inf204 Eingebettete Systeme II

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

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

Total time of attendance for the module 56 h
**inf335 - Strategy Synthesis**

**Module label**  
Strategy Synthesis

**Module code**  
inf335

**Credit points**  
6.0 KP

**Workload**  
180 h

**Used in course of study**  
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction  
- Master Informatik > Technische Informatik

**Entry requirements**  
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.

**Reader’s advisory**  
Suggested reading:


Links

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<tr>
<th>Language of instruction</th>
<th>English</th>
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<td>Modullevel</td>
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<tr>
<td>Modular</td>
<td>Pflicht o. Wahlpflicht / compulsory or optional</td>
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<td>Lern-/Lehrform / Type of program</td>
<td>V + Ü</td>
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<td>Vorkenntnisse / Previous knowledge</td>
<td>A BSc. in CS with a specialisation equivalent to &quot;embedded systems and microrobotics&quot; or corresponding knowledge from the MSc: The lecture assumes familiarity with the modelling and analysis of reactive systems.</td>
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<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
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<td>Written or oral exam</td>
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<td>Exercises</td>
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<td>SuSe and WiSe</td>
<td>28 h</td>
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Total time of attendance for the module: 56 h
inf336 - Application Area Automotive

<table>
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<tr>
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<th>Application Area Automotive</th>
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<tbody>
<tr>
<td>Module code</td>
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<td>6.0 KP</td>
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<td>Workload</td>
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**Used in course of study**
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Technische Informatik

**Contact person**
- Module responsibility
  - Frank Köster
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**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

**Reader's advisory**

Springer.

Links

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<td>V+U</td>
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Vorkenntnisse / Previous knowledge

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<td>28 h</td>
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<td>SuSe</td>
<td>28 h</td>
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Total time of attendance for the module 56 h
inf338 - Design of Autonomous Systems

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<td>Workload</td>
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| Used in course of study | • Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction  
                          • Master Informatik > Technische Informatik |

Contact person
- Module responsibility
  - Martin Georg Fränzle
  - Die im Modul Lehrenden
- Authorized examiners
  - Die im Modul Lehrenden
  - Martin Georg Fränzle

Entry requirements

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

Reader's advisory
- The module consists of a lecture and an exercise part

Links
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: once a year
- Module capacity: unlimited
- Modullevel: AS (Akzentsetzung / Accentuation)
- Modulart: Pflicht o. Wahlpflicht / compulsory or optional
- Lern-/Lehrform / Type of program: V+Ü

Vorkenntnisse / Previous knowledge

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<td>Lecture</td>
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<td>Exercises</td>
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<td>SuSe and WiSe</td>
<td>28 h</td>
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Total time of attendance for the module: 56 h
inf350 - Special Topics in 'Safety-Critical Systems’ I

Module label
Special Topics in ‘Safety-Critical Systems’ I

Module code
inf350

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein

Authorized examiners
- Andreas Hein

Entry requirements

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. „Sicherheitsanalysetechniken“, „Zielarchitekturen Eingebetteter Systeme für Automotive-Anwendungen“, „Modellbasieter Systementwurf“,...

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge
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<th>Type of examination</th>
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**Course type**  
Course selection

**SWS**  
4.00

**Frequency**  
SuSe or WiSe

**Workload attendance**  
56 h
inf351 - Special Topics in 'Safety-Critical Systems’ II

Module label
Special Topics in 'Safety-Critical Systems’ II

Module code
inf351

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements
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. „Sicherheitsanalysetechniken“, „Modellbasierter Systementwurf“, ...

Reader’s advisory
As announced in course

Links
Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge
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inf352 - Current Topics in 'Safety-Critical Systems' I

Module label  
Current Topics in 'Safety-Critical Systems' I

Module code  
inf352

Credit points  
3.0 KP

Workload  
90 h

Used in course of study  
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person  
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements  
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

Reader's advisory  
As announced in course

Links  
Language of instruction  
German

Duration (semesters)  
1 Semester

Module frequency  
unregelmäßig

Module capacity  
unlimited

Modullevel  
AS (Akzentsetzung / Accentuation)

Modulart  
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program  
S or V
### Previous knowledge

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inf353 - Current Topics in 'Safety-Critical Systems' II

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| **Used in course of study** | Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule  
|                  | Master Informatik > Technische Informatik     |
| **Contact person** | Module responsibility                     |
|                  | Andreas Hein                               |
|                  | Die im Modul Lehrenden                      |
| **Authorized examiners** |                          |
|                  | Andreas Hein                               |
|                  | Die im Modul Lehrenden                      |

**Entry requirements**

**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

**Reader's advisory**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Modullevel**

AS (Akzentsetzung / Accentuation)

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht

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

S or V
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inf354 - Special Topics in 'Hybrid Systems' I

Module label: Special Topics in 'Hybrid Systems' I
Module code: inf354
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility:
- Andreas Hein
- Martin Georg Fränzle
- Die im Modul Lehrenden

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

Entry requirements
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. „Modellbasierter Systementwurf“, „Konstruktionsprinzipien ausgewählter Klassen von Fahrzeugfunktionen“

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht
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inf355 - Special Topics in 'Hybrid Systems' II

Module label: Special Topics in 'Hybrid Systems' II
Module code: inf355
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Martin Georg Fränzle
- Die im Modul Lehrenden

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

Entry requirements
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
Reader's advisory
As announced in course
Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
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inf356 - CurrentTopics in 'Hybrid Systems' I

Module label
CurrentTopics in 'Hybrid Systems' I

Module code
inf356

Credit points
3.0 KP

Workload
90 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Martin Georg Fränzle
- Die im Modul Lehrenden

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

Entry requirements

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

Reader's advisory
As announced in course

Links

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht
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inf357 - Aktuelle Themen aus dem Gebiet "Hybride Systeme" II

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**Contact person**

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<tr>
<td>Andreas Hein</td>
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<tr>
<td>Martin Georg Fränzle</td>
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<td>Die im Modul Lehrenden</td>
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**Authorized examiners**

| Andreas Hein                         |
| Martin Georg Fränzle                  |
| Die im Modul Lehrenden                |

**Entry requirements**

**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

**Reader's advisory** As announced in course

**Links**

**Language of instruction** German

**Duration (semesters)** 1 Semester

**Module frequency** unregelmäßig

**Module capacity** unlimited

**Modulelevel** AS (Akzentsetzung / Accentuation)

**Modulart** je nach Studiengang Pflicht oder Wahlpflicht
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### Module Contents
See assigned course description, e.g. „Spezifikation und Modellierung Eingebetteter Systeme“

### Reader’s Advisory
As announced in course

### Links

<table>
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**inf359 - Spezielle Themen aus dem Gebiet "Hardware-/Software-Systeme" II**

**Module label**  
Spezielle Themen aus dem Gebiet "Hardware-/Software-Systeme" II

**Module code**  
inf359

**Credit points**  
6.0 KP

**Workload**  
180 h

**Used in course of study**
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

**Contact person**

- **Module responsibility**
  - Andreas Hein
  - Wolfgang Nebel
  - Die im Modul Lehrenden

- **Authorized examiners**
  - Andreas Hein
  - Wolfgang Nebel
  - Die im Modul Lehrenden

**Entry requirements**

**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“

**Reader's advisory**  
As announced in course

**Links**

**Language of instruction**  
German

**Duration (semesters)**  
1 Semester

**Module frequency**  
unregelmäßig

**Module capacity**  
unlimited

**Modullevel**  
AS (Akzentsetzung / Accentuation)

**Modulart**  
je nach Studiengang Pflicht oder Wahlpflicht
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### inf360 - CurrentTopics in 'Hardware/Software Systems' I

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| Used in course of study | • Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule  
• Master Informatik > Technische Informatik |

**Contact person**

- Module responsibility
  - Andreas Hein
  - Wolfgang Nebel
  - Die im Modul Lehrenden

- Authorized examiners
  - Andreas Hein
  - Wolfgang Nebel
  - Die im Modul Lehrenden

**Entry requirements**

**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. „Energieeffizienz in der IKT“, „Smart Resource Integration“, ...

**Reader's advisory**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

unregelmäßig

**Module capacity**

unlimited

**Module level**

AS (Akzentsetzung)

**Modulart**

Wahlpflicht
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inf361 - Current Topics in 'Hardware/Software Systems' II

Module label: Current Topics in 'Hardware/Software Systems' II
Module code: inf361
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Wolfgang Nebel
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Wolfgang Nebel
- Die im Modul Lehrenden

Entry requirements
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. „Energieeffizienz in der IKT“, „Smart Resource Integration“, ...

Reader's advisory
As announced in course

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
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inf366 - Special Topics in 'Microrobotics and Control Engineering' I

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

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person

Module responsibility
- Andreas Hein
- Sergej Fatikow
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Sergej Fatikow
- Die im Modul Lehrenden

Entry requirements

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. „Nanomontage und Nanohandhabung“

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited
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<td>Workload attendance</td>
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</table>
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
<table>
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inf368 - Aktuelle Themen aus dem Gebiet "Mikrorobotik und Regelungstechnik" I

Module label
 Aktuelle Themen aus dem Gebiet "Mikrorobotik und Regelungstechnik" I

Module code
 inf368

Credit points
 3.0 KP

Workload
 90 h

Used in course of study
• Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
• Master Informatik > Technische Informatik

Contact person
 Module responsibility
  • Andreas Hein
  • Sergej Fatikow
  • Die im Modul Lehrenden

Authorized examiners
  • Andreas Hein
  • Sergej Fatikow
  • Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links
Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht
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inf369 - Current Topics in 'Microrobotics and Control Engineering' II

Module label: Current Topics in 'Microrobotics and Control Engineering' II
Module code: inf369
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements
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

Reader's advisory
As announced in course

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Module level: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program: S or V
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inf374 - Special Topics in 'Automotive' I

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<td>- Andreas Hein</td>
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<td>- Martin Georg Fränzle</td>
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**Entry requirements**

**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. „Zielarchitekturen Eingebetteter Systeme für Automotive-Anwendungen“

**Reader's advisory**

As announced in course

**Links**

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

halbjährlich

**Module capacity**

unlimited

**Modullevel**

AS (Akzentsetzung / Accentuation)

**Modulart**

je nach Studiengang Pflicht oder Wahlpflicht
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inf375 - Special Topics in 'Automotive' II

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**Entry requirements**

**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

**Reader's advisory**

As announced in course

**Links**

- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modullevel: AS (Akzentsetzung / Accentuation)
- Modulart: je nach Studiengang Pflicht oder Wahlpflicht
- Lern-/Lehrform / Type of program: 2 courses out of V, S, Ü, P, PR
- Vorkenntnisse / Previous knowledge

174 / 297
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inf376 - Current Topics in 'Automotive' I

Module label
Current Topics in 'Automotive' I

Module code
inf376

Credit points
3.0 KP

Workload
90 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
S or V
| Vorkenntnisse / Previous knowledge
| Examination | Time of examination | Type of examination |
| Final exam of module | At the end of the lecture period | Presentation or oral exam |
| Course type | Course or seminar |
| SWS | 2.00 |
| Frequency | WiSe |
| Workload attendance | 28 h |
inf377 - Current Topics in 'Automotive' II

Module label
Current Topics in 'Automotive' II

Module code
inf377

Credit points
3.0 KP

Workload
90 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Andreas Hein
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
S or V
<table>
<thead>
<tr>
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<th>Time of examination</th>
<th>Type of examination</th>
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<td>Presentation or oral exam</td>
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<tr>
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inf705 - Practical in Computer Science Education

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<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
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<td>Used in course of study</td>
<td>Master Informatik &gt; Technische Informatik</td>
</tr>
</tbody>
</table>

**Contact person**
- Module responsibility
  - Ira Diethelm
  - Die im Modul Lehrenden
- Authorized examiners
  - Ira Diethelm
  - Die im Modul Lehrenden

**Entry requirements**

**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.

**Reader's advisory**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

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

**Vorkenntnisse / Previous knowledge**

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inf710 - Special Topics in 'Computer Science Education' I

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**Contact person**
Module responsibility
- Ira Diethelm
- Die im Modul Lehrenden

Authorized examiners
- Ira Diethelm
- Die im Modul Lehrenden

**Entry requirements**
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

**Reader's advisory**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**
2 courses out of V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**
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inf711 - Spezielle Themen aus dem Gebiet "Informatik in der Bildung" II

<table>
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<th>Module label</th>
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**Contact person**

- Ira Diethelm
- Die im Modul Lehrenden

**Entry requirements**

**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

**Reader's advisory**

As announced in course

**Links**

**Language of instruction**

- German

**Duration (semesters)**

- 1 Semester

**Module frequency**

- unregelmäßig

**Module capacity**

- unlimited

**Modullevel**

- AS (Akzentsetzung / Accentuation)

**Modulart**

- je nach Studiengang Pflicht oder Wahlpflicht
<table>
<thead>
<tr>
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inf713 - Aktuelle Themen aus dem Gebiet "Informatik in der Bildung" II

Module label: Aktuelle Themen aus dem Gebiet "Informatik in der Bildung" II
Module code: inf713
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master Informatik > Technische Informatik

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

Entry requirements:

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

Reader's advisory:
- As announced in course

Links:

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Module level: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-Lehrform / Type of program: S or V
Vorkenntnisse / Previous knowledge:
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<th>Type of examination</th>
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<td>Presentation or oral exam</td>
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<td>2.00</td>
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## Praktische Informatik

### inf100 - Human Computer Interaction

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<td><strong>Workload</strong></td>
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<td>• Master Eingebettete Systeme und Mikrorobotik &gt; Akzentsetzungsmodule</td>
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<tr>
<td></td>
<td>• Master Engineering of Socio-Technical Systems &gt; Embedded Brain Computer Interaction</td>
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<tr>
<td></td>
<td>• Master Engineering of Socio-Technical Systems &gt; Human-Computer Interaction</td>
</tr>
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<td></td>
<td>• Master Informatik &gt; Praktische Informatik</td>
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<tr>
<td></td>
<td>• Master Wirtschaftsinformatik &gt; Bereichswahlmodule</td>
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### Contact person

**Module responsibility**

- Susanne Boll-Westermann
- Die im Modul Lehrenden

**Authorized examiners**

- Susanne Boll-Westermann
- Die im Modul Lehrenden

### Entry requirements

#### Skills to be acquired in this module

**Professional competence**

The students:

- Name the human-computer interaction core principles
- Characterise the basic elements of the human-centered design of interactive systems

**Methodological competence**

The students:

- Comprehend context of use and user requirements of human-machine interfaces
- Design, develop and evaluate human-machine interfaces
- Conduct experiments with their prototypes

**Social competence**

The students:

- Implement human-computer interfaces in practical hands-on projects in teams
- Evaluate human-machine interfaces with potential users
- Develop and present solutions for Human-Computer Interaction related problems
- Integrate technical and factual comments into own results

### Module contents

The module introduces the field of human-computer interfaces and their historical context. Moreover, it shows motivating examples of human-computer interaction. The module covers the core principles of human-computer interaction. In detail, the module deals with the design concepts of interactive systems: context of use, requirements and task analysis, human perception capabilities, design process, usability, prototyping and evaluation. During the practical project a concrete human-computer interface will be designed, developed and evaluated according to these concepts.

### Reader's advisory

- 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

### Language of instruction

- German

### Duration (semesters)

- 1 Semester

### Module frequency

- once a year

### Module capacity

- unlimited

### Module level

- AS (Akzentsetzung / Accentuation)
### Modulart
Pflicht o. Wahlpflicht / compulsory or optional

### Lern-/Lehrform / Type of program
V+P

### Vorkenntnisse / Previous knowledge
Basic programming skills

### Examination
<table>
<thead>
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<tr>
<td>Final exam of module</td>
<td>Practical group project which progress has to 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. Find out more about the schedule on the websites of the department and in Stud.IP. Practical exam on the topics of the lecture. Oral exam and oral exam count 50% each to the final grade. Both practical project and oral exam have to be passed individually.</td>
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### Course type
<table>
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**Total time of attendance for the module**
56 h
inf105 - Fault Tolerance in Distributed Systems

Module label: Fault Tolerance in Distributed Systems
Module code: inf105
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Praktische Informatik

Contact person
Module responsibility
- Oliver Theel
- Die im Modul Lehrenden

Authorized examiners
- Die im Modul Lehrenden
- Die Modulverantwortlichen

Module counseling
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
jährlich

Module capacity
unlimited

Reference text
connectet with:
Betriebssysteme 1 und 2
Betriebssysteme-Praktikum
Verteilte Betriebssysteme

Modullevel
AS (Akzentsetzung / Accentuation)

Modulart
Wahlpflicht / Elective

Lern-Lehrform / Type of program
V+S or V+Ü

Vorkenntnisse / Previous knowledge
Verteilte Betriebssysteme

Final exam of module
End of lecture period
written exam or oral exam or practical work

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Total time of attendance for the module
56 h
**inf108 - Requirements Engineering and Management**

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| Used in course of study |  - Master Informatik > Praktische Informatik  
                          - Master Wirtschaftsinformatik > Bereichswahlmodule |
| Contact person | Module responsibility  
                   - Andreas Winter  
                   - Die im Modul Lehrenden |
| Authorized examiners |  - Andreas Winter  
                         - Die im Modul Lehrenden |

**Entry requirements**

**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

**Reader's advisory**

- Chris Rupp: Requirements-Engineering und -Management: Professionelle, iterative
<table>
<thead>
<tr>
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<tr>
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<tbody>
<tr>
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<td>Practical</td>
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**Total time of attendance for the module**: 56 h
inf109 - Information Systems III

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

Used in course of study:
- Master Informatik > Praktische Informatik
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person:
Module responsibility:
- Marco Grawunder
- Die im Modul Lehrenden

Authorized examiners:
- Marco Grawunder
- Die im Modul Lehrenden

Entry requirements:

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.

Reader's advisory:

- 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: AS (Akzentsetzung / Accentuation)

Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program: V+Ü

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

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

Course type: Comment | SWS | Frequency | Workload attendance
Lecture: | 2.00 | WiSe | 28 h
Exercises: | 2.00 | WiSe | 28 h
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inf111 - Advanced Database Practical

Module label: Advanced Database Practical
Module code: inf111
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Praktische Informatik
- Master Wirtschaftsinformatik > Bereichswahlmodule

Contact person:
Module responsibility:
- Marco Grawunder
- Die im Modul Lehrenden

Authorized examiners:
- Marco Grawunder
- Die im Modul Lehrenden

Entry requirements:
- 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 und 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.

Reader's advisory:
Suggested reading:
- Held Andrea (2007), Oracle 10g Addison-Wesley.
<table>
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<tr>
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<tr>
<td>Language of instruction</td>
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<td>Modulart</td>
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<td>Workload attendance</td>
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- 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
inf112 - Modern Programming Technologies Practical

Module label: Modern Programming Technologies Practical

Module code: inf112

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master Informatik > Praktische Informatik
- Master Wirtschaftsinformatik > Bereichswahlmodule

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

Entry requirements:

Skills to be acquired in this module:
The objective of the practical course is to provide the students with state-of-the-art programming techniques. After the course, the students are able to use these techniques during the implementation and development of applications.

Professional competence:
The students:
- Name state-of-the-art programming techniques

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

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

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

Module contents:
The practical course enhances the students' programming skills. It focuses on state-of-the-art programming techniques. Among others, these are .NET-Framework, OSGi, Java EE, Java ME, iOS Application development, Android Application development or Social Network API.

Reader's advisory:
Online-Documentation of the technologies and systems

Links:
http://www-is.informatik.uni-oldenburg.de/~dibo/teaching/programmierpraktikum/

Language of instruction:
German

Duration (semesters):
1 Semester

Module frequency:
jährlich

Module capacity:
unlimited

Modullevel:
AS (Akzentsetzung / Accentuation)

Modulart:
je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program:
- Proper programming skills

Vorkenntnisse / Previous knowledge:

Examination:
Time of examination:

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

Exercises an oral exam, Programming tasks during the semester; short oral exam

Course type:
Practical
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inf113 - Operating Systems II

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<td>Oliver Theel</td>
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</table>

### Entry requirements

**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

### Reader's advisory


### Links

- Language of instruction: German
- Duration (semesters): 1 Semester
<table>
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| Total time of attendance for the module | 56 h |
inf131 - Advanced Topics in Human Computer Interaction

Module label: Advanced Topics in Human Computer Interaction

Module code: inf131

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Informatik > Angewandte Informatik
- Master Informatik > Praktische Informatik

Contact person:

Module responsibility:
- Susanne Boll-Westermann
- Die im Modul Lehrenden

Authorized examiners:
- Die im Modul Lehrenden

Entry requirements:

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.

Course prerequisite: Mensch-Maschine-Interaktion (Human Computer Interaction)

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 artifact

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:

- Be comfortable tackling original research questions
- Ability in conceptualizing and running both qualitative and quantitative HCI experiments
- 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.

Structure of the Module:

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.

Lectures: 2 hours per week
Lab: 2 hours per week

This lecture will be held in English. All assignment submissions and exams will be in English.

The primary audience for this class are Master students of Computer Science following the Human Computer Interaction track.

Reader's advisory

Suggested reading:


Links

Language of instruction

English

Duration (semesters)

1 Semester

Module frequency

semi-annual

Module capacity

24

Module level

AS (Akzentsetzung / Accentuation)

Moduleart

Pflicht o. Wahlpflicht / compulsory or optional

Lern-/Lehrform / Type of program

V+P

Vorkenntnisse / Previous knowledge

Interaktive Systeme

Examination

Time of examination

Type of examination

Final exam of module

At the end of the lecture period

Project and oral exams

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:

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<tr>
<td>Final</td>
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<td>Assignments A01-03</td>
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<td>Mini HCI research project 20</td>
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Course type

Comment SWS Frequency Workload attendance

Lecture 2.00 SuSe or WiSe 28 h

Practical 2.00 SuSe or WiSe 28 h

Total time of attendance for the module 56 h
inf170 - Special Topics in 'Information Systems' I

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

**Module code**
inf170

**Credit points**
6.0 KP

**Workload**
180 h

**Used in course of study**
- Master Informatik > Praktische Informatik

**Contact person**
Module responsibility
- Marco Grawunder
- Die im Modul Lehrenden

Authorized examiners
- Marco Grawunder
- Die im Modul Lehrenden

**Entry requirements**
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**
According to the assigned course

**Reader's advisory**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Module level**
AS (Akzentsetzung / Accentuation)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**
2 courses out of V, S, Ü, P, PR (4 SWS)

**Vorkenntnisse / Previous knowledge**
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<th>Type of examination</th>
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<td>Portfolio or presentation or oral exam</td>
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**Course type**  
Course selection

**SWS**  
4.00

**Frequency**  
WiSe

**Workload attendance**  
56 h
inf171 - Special Topics in 'Information Systems' I

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

**Module code**
inf171

**Credit points**
6.0 KP

**Workload**
180 h

**Used in course of study**
- Master Informatik > Praktische Informatik

**Contact person**
Module responsibility
- Marco Grawunder
- Die im Modul Lehrenden

Authorized examiners
- Marco Grawunder
- Die im Modul Lehrenden

**Entry requirements**

**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**
According to the assigned course

**Reader’s advisory**
As announced in course

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel**
---

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**
2 courses out of V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**
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inf172 - Special Topics in 'Information Systems' I

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

**Module code**  
inf172

**Credit points**  
3.0 KP

**Workload**  
90 h

**Used in course of study**  
- Master Informatik > Praktische Informatik

**Contact person**  
Module responsibility
- Marco Grawunder
- Lehrende der Informatik

**Entry requirements**

**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

**Reader's advisory**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung)

**Modulart**
Wahlpflicht

**Lern-/Lehrform / Type of program**
V or S

**Vorkenntnisse / Previous knowledge**

**Examination**
Time of examination  
Type of examination

**Final exam of module**
At the end of the lecture period  
Presentation or oral exam
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inf173 - Special Topics in 'Information Systems' II

Module label | Special Topics in 'Information Systems' II
---|---
Module code | inf173
Credit points | 3.0 KP
Workload | 90 h

Used in course of study | Master Informatik > Praktische Informatik

Contact person

Module responsibility
- Marco Grawunder
- Die im Modul Lehrenden

Authorized examiners
- Marco Grawunder
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | unregelmäßig
Module capacity | unlimited
Modulelevel | AS (Akzentsetzung / Accentuation)
Modulart | je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program | V or S
Previous knowledge |
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inf174 - Special Topics in 'Media Informatics and Multimedia Systems' II

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| Used in course of study           | • Master Engineering of Socio-Technical Systems > Human-Computer Interaction  
• Master Informatik > Praktische Informatik |
| Contact person                    |                                                               |
| Module responsibility             |                                                               |
| • Susanne Boll-Westermann         |                                                               |
| • Die im Modul Lehrenden          |                                                               |
| Module counseling                 |                                                               |
| • Die im Modul Lehrenden          |                                                               |

**Entry requirements**

**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**

According to the assigned course

**Reader's advisory**

As announced in course

**Links**

Languages of instruction: German, English

Duration (semesters): 1 Semester

Module frequency: irregular

Module capacity: unlimited

Module level: AS (Akzentsetzung / Accentuation)

Moduleart: Pflicht o. Wahlpflicht / compulsory or optional

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

Vorkenntnisse / Previous knowledge

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inf175 - Special Topics in 'Media Informatics and Multimedia Systems' II

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| Used in course of study | • Master Engineering of Socio-Technical Systems > Human-Computer Interaction  
                        | • Master Informatik > Praktische Informatik                     |

**Contact person**

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

**Entry requirements**

- **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**

- According to the assigned course

**Reader's advisory**

- As announced in course

**Links**

- **Languages of instruction**
  - German, English
- **Duration (semesters)**
  - 1 Semester
- **Module frequency**
  - unregelmäßig
- **Module capacity**
  - unlimited
- **Modullevel**
  - AS (Akzentsetzung / Accentuation)
- **Modulart**
  - Pflicht o. Wahlpflicht / compulsory or optional
- **Lern-Lehrform / Type of program**
  - 2 courses out of V, S, Ü, P, PR
- **Vorkenntnisse / Previous knowledge**
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inf176 - Special Topics in 'Media Informatics and Multimedia Systems' I

Module label: Special Topics in 'Media Informatics and Multimedia Systems' I
Module code: inf176
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master Informatik > Praktische Informatik

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

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

Entry requirements:
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
Reader's advisory
As announced in course

Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modulelevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program: S or V

Vorkenntnisse / Previous knowledge
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inf177 - Special Topics in 'Media Informatics and Multimedia Systems' II

**Module label**
Special Topics in 'Media Informatics and Multimedia Systems' II

**Module code**
inf177

**Credit points**
3.0 KP

**Workload**
90 h

**Used in course of study**
- Master Informatik > Praktische Informatik

**Contact person**

- Module responsibility
  - Susanne Boll-Westermann
  - Lehrende der Informatik
- Authorized examiners
  - Susanne Boll-Westermann
  - Die im Modul Lehrenden

**Entry requirements**

**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**
As in the description of the assigned course

**Reader's advisory**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**
S or V

**Vorkenntnisse / Previous knowledge**
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**Course type**
- Course or seminar

**SWS**
- 2.00

**Frequency**
- SuSe or WiSe

**Workload attendance**
- 28 h
inf178 - Special Topics in 'Software Engineering' I

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

Used in course of study:
- Master Informatik > Praktische Informatik

Contact person:
Module responsibility:
  - Andreas Winter
  - Die im Modul Lehrenden

Authorized examiners:
  - Andreas Winter
  - Die im Modul Lehrenden

Entry requirements:

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 the assigned course description

Reader's advisory:
As announced in course

Links:

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: ---
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-Lehrform / Type of program: 2 courses out of V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge:

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inf179 - Special Topics in 'Software Engineering' II

Module label: Special Topics in 'Software Engineering' II
Module code: inf179
Credit points: 6.0 KP
Workload: 180 h
Used in course of study: Master Informatik > Praktische Informatik

Contact person:
Module responsibility
- Andreas Winter
- Die im Modul Lehrenden

Authorized examiners
- Andreas Winter
- Die im Modul Lehrenden

Entry requirements

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 the assigned course description
Reader's advisory
As announced in course

Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modulelevel: ---
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-Lehrform / Type of program: 2 courses out of V, S, Ü, P, PR
Vorkenntnisse / Previous knowledge
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inf180 - Current Topics in 'Software Engineering' I

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

Used in course of study:
- Master Informatik > Praktische Informatik

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

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program: S or V

Vorkenntnisse / Previous knowledge

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inf181 - Current Topics in 'Software Engineering' I

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<td>Workload</td>
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<td>Module responsibility</td>
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<tr>
<td></td>
<td>• Andreas Winter</td>
</tr>
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<td>• Die im Modul Lehrenden</td>
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<td>• Andreas Winter</td>
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<td>• Die im Modul Lehrenden</td>
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Entry requirements

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>
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<td>Time of examination</td>
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<td>SuSe or WiSe</td>
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inf182 - Special Topics in 'System Software and Distributed Systems' I

<table>
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<td>Module responsibility</td>
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<td></td>
<td>• Oliver Theel</td>
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<td>• Die im Modul Lehrenden</td>
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<td>• Oliver Theel</td>
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Entry requirements

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

Reader’s advisory
As announced in course

Links

<table>
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<td>Modullevel</td>
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<td>2 courses out of V, S, Ü, P, PR</td>
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Vorkenntnisse / Previous knowledge
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| SWS                          | 4.00                             |                                  |
| Frequency                    | WiSe                             |                                  |
| Workload attendance          | 56 h                             |                                  |
inf183 - Special Topics in 'System Software and Distributed Systems' II

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Contact person

- Module responsibility
  - Oliver Theel
  - Die im Modul Lehrenden
- Authorized examiners
  - Oliver Theel
  - Die im Modul Lehrenden

Entry requirements

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

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

Reader's advisory

As announced in course

Links

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

unregelmäßig

Module capacity

unlimited

Modulart

je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

V+Ü

Vorkenntnisse / Previous knowledge
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<td>Portfolio or presentation or oral exam</td>
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<tr>
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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

Module code
inf184

Credit points
3.0 KP

Workload
90 h

Used in course of study
- Master Informatik > Praktische Informatik

Contact person

Module responsibility
- Oliver Theel
- Die im Modul Lehrenden

Authorized examiners
- Oliver Theel
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modulart
---

Lern-/Lehrform / Type of program
S or V

Vorkenntnisse / Previous knowledge
<table>
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inf185 - Current Topics in 'System Software and Distributed Systems' II

Module label  Current Topics in 'System Software and Distributed Systems' II
Module code    inf185
Credit points  3.0 KP
Workload       90 h

Used in course of study
- Master Informatik > Praktische Informatik

Contact person
Module responsibility
- Oliver Theel
- Die im Modul Lehrenden

Authorized examiners
- Oliver Theel
- Die im Modul Lehrenden

Entry requirements

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

Reader's advisory
As announced in course

Links
Language of instruction  German
Duration (semesters)  1 Semester
Module frequency  unregelmäßig
Module capacity  unlimited
Modullevel  AS (Akzentsetzung / Accentuation)
Modulart  je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program  S or V

Vorkenntnisse / Previous knowledge
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<td>Frequency</td>
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Theoretische Informatik

inf300 - Hybrid Systems

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

- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Informatik > Technische Informatik
- Master Informatik > Theoretische Informatik

Contact person

Module responsibility

- Martin Georg Fränzle
- Die im Modul Lehrenden

Authorized examiners

- Martin Georg Fränzle
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module

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 tools.

**Reader's advisory**


**Links**

**Languages of instruction**
English, German

**Duration (semesters)**
1 Semester

**Module frequency**
Once a year

**Module capacity**
Unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Modulart**
Pflicht o. Wahlpflicht / compulsory or optional

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

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Final exam of module**

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<td>1.00</td>
<td>SuSe</td>
<td>14 h</td>
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**Total time of attendance for the module**

56 h
### inf450 - Correctness of Graph Programs

<table>
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</table>
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule  
- Master Informatik > Theoretische Informatik |

**Contact person**

- **Module responsibility**  
  - Annegret Habel  
  - Die im Modul Lehrenden  
- **Authorized examiners**  
  - Andreas Hein  
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**  
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.

**Reader's advisory**


**Links**

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### Lern-/Lehrform / Type of program

<table>
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<td>14 h</td>
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Total time of attendance for the module 56 h
inf451 - Complexity Theory

Module label | Complexity Theory
Module code | inf451
Credit points | 6.0 KP
Workload | 180 h

Used in course of study
- Master Informatik > Theoretische Informatik

Contact person
Module responsibility
- Eike Best
- Die im Modul Lehrenden
Authorized examiners
- Eike Best
- Die im Modul Lehrenden

Entry requirements
- 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

Reader's advisory
- Eike Best: Skript zur Vorlesung (2015)

Links
Language of instruction  | German  
Duration (semesters)   | 1 Semester  
Module frequency      | unregelmäßig  
Module capacity        | unlimited  
Modullevel             | AC (Aufbaucurriculum / Composition)  
Modulart               | je nach Studiengang Pflicht oder Wahlpflicht  

Lern-Lehrform / Type of program

Vorkenntnisse / Previous knowledge

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Course type | Comment | SWS | Frequency | Workload attendance |
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Total time of attendance for the module 56 h
inf453 - Combination of Specification Techniques

Module label: Combination of Specification Techniques
Module code: inf453
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Informatik > Theoretische Informatik

Contact person:
Module responsibility:
- Andreas Hein
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Authorized examiners:
- Andreas Hein
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Entry requirements:
- inf400/inf401 Theoretische Informatik I and II

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

Reader's advisory

Essential:


Recommended:


Links

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: ---
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program:

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

Examination:
Time of examination: At the end of the lecture period
Type of examination: exercises and oral exam

Final exam of module:

<table>
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<th>Comment</th>
<th>SWS</th>
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Total time of attendance for the module: 56 h
inf454 - Communicating and Mobile Systems

Module label: Communicating and Mobile Systems
Module code: inf454
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Theoretische Informatik

Contact person:
Module responsibility:
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

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

Entry requirements:

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

Professional competence:
The students:
- Know the theory of the operational semantics of CCS and the \( ? \)-calculus
- Perform equivalence proofs using simulations and bisimulations
- Specify communicating and mobile systems with CCS and the \( ? \)-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 \( ? \)-calculus. It enables a new modelling of communication, taking the location of the communication into account.

The \( ? \)-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 \( ? \)-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 \( ? \)-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 \( ? \)-calculus
- proof of strong equivalence and observational equivalence of given processes
• specification of dynamic data structures in the \( ? \)-calculus

### Reader's advisory


### Links

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**Total time of attendance for the module**

56 h
inf456 - Real-Time Systems

**Module label**  
Real-Time Systems

**Module code**  
inf456

**Credit points**  
6.0 KP

**Workload**  
180 h

**Used in course of study**
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Theoretische Informatik

**Contact person**

**Module responsibility**
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

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

**Entry requirements**

**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 UPPAAAL 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

Reader's advisory

essential:


recommended:


Links

Languages of instruction German, English
Duration (semesters) 1 Semester
Module frequency irregular
Module capacity unlimited
Modulelevel AS (Akzentsetzung / Accentuation)
Modulart Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program V+Ü
Vorkenntnisse / Previous knowledge Theoretical Computer Science I and II

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Total time of attendance for the module 56 h
inf458 - Term Rewriting Systems

**Module label**
Term Rewriting Systems

**Module code**
inf458

**Credit points**
6.0 KP

**Workload**
180 h

**Used in course of study**
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodulle
- Master Informatik > Theoretische Informatik

**Contact person**
Module responsibility
- Annegret Habel
- Die im Modul Lehrenden

**Entry requirements**

**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.

**Reader’s advisory**

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

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

**Module capacity**
unlimited
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**Total time of attendance for the module** 56 h
inf460 - Security

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**Used in course of study**
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Theoretische Informatik

**Contact person**

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<tr>
<td>Sibylle Fröschle</td>
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**Authorized examiners**
- Die im Modul Lehrenden
- Sibylle Fröschle

**Entry requirements**

**Skills to be acquired in this module**

**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.

**Reader's advisory**

### 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

### Module level
AS (Akzentsetzung / Accentuation)

### Module art
Pflicht o. Wahlpflicht / compulsory or optional

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

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

### Examination
- Final exam of module will be specified in class
- Presentation and paper, oral exam, or exam (depending on the number of students)

### Course type
Course or seminar

### SWS
2.00

### Frequency
SuSe

### Workload attendance
28 h
**inf461 - Security of Cyber-Physical Systems**

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| Used in course of study | • Master Engineering of Socio-Technical Systems > Systems Engineering  
  • Master Informatik > Theoretische Informatik |

**Contact person**

- Module responsibility
  - Sibylle Fröschle
  - Die im Modul Lehrenden
- Authorized examiners
  - Die im Modul Lehrenden
  - Sibylle Fröschle

**Entry requirements**

**Skills to be acquired in this module**

**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 countermeasures, 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.

**Reader's advisory**

Recent scientific papers and reports in the public domain news.

**Links**

http://vhome.offis.de/sibyllef

**Language of instruction**

English

**Duration (semesters)**

1 Semester
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inf480 - Special Topics in 'Parallel Systems' I

Module label
Special Topics in 'Parallel Systems' I

Module code
inf480

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master Informatik > Theoretische Informatik

Contact person
Module responsibility
- Eike Best
- Die im Modul Lehrenden

Authorized examiners
- Eike Best
- Die im Modul Lehrenden

Entry requirements

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. „Automatentheorie und Logik“„Modelchecking“, „Effiziente Algorithmen“ und „Theorie und Spiele“.

Reader's advisory
As announced in course

Links

Language of instruction
German

Duration (semesters)
1 Semester

Module frequency
unregelmäßig

Module capacity
unlimited

Modullevel
AC (Aufbaucurriculum / Composition)

Modulart
je nach Studiengang Pflicht oder Wahlpflicht

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

Vorkenntnisse / Previous knowledge
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## inf481 - Special Topics in 'Parallel Systems' II

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**Used in course of study**
- Master Informatik > Theoretische Informatik

**Contact person**
- Module responsibility
  - Eike Best
  - Die im Modul Lehrenden
- Authorized examiners
  - Eike Best
  - Die im Modul Lehrenden

**Entry requirements**
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. „Automatentheorie und Logik“, „Modelchecking“, „Effiziente Algorithmen“ und „Theorie und Spiele“.

**Reader’s advisory**
As announced in course

**Links**

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel**
AC (Aufbaucurriculum / Composition)

**Modulart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**
2 courses out of V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**
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inf482 - Current Topics in 'Parallel Systems' I

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Contact person

- Module responsibility
  - Eike Best
  - Die im Modul Lehrenden

Authorized examiners

- Eike Best
- Die im Modul Lehrenden

Entry requirements

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

Reader’s advisory

As announced in course

Links

Language of instruction

German

Duration (semesters)

1 Semester

Module frequency

unregelmäßig

Module capacity

unlimited

Modullevel

AC (Aufbaucurriculum / Composition)

Modulart

je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

S or V

Vorkenntnisse / Previous knowledge
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Inf483 - Current Topics in 'Parallel Systems' II

Module label: Current Topics in 'Parallel Systems' II
Module code: inf483
Credit points: 3.0 KP
Workload: 90 h
Used in course of study:
- Master Informatik > Theoretische Informatik

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

Entry requirements
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

Reader's advisory:
As announced in course

Links
Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modullevel: AS (Akzentsetzung / Accentuation)
Modulart:
- je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program:
- S or V

Vorkenntnisse / Previous knowledge
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inf484 - Special Topics in 'Correct Systems Design' I

<table>
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<td>Credit points</td>
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<td>Contact person</td>
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<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>- Ernst-Rüdiger Olderog</td>
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<td>- Die im Modul Lehrenden</td>
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<tr>
<td>Authorized examiners</td>
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<td>- discuss and evaluate recent computer science developments</td>
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<td>Methodological competences</td>
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<td></td>
<td>The students:</td>
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<td>- evaluate and apply tools, technology and methods sophisticatedly</td>
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<tr>
<td></td>
<td>- support team process by their abilities</td>
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<tr>
<td>Self-competences</td>
<td></td>
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<tr>
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<td>- pursue the overall and special computer science development critically</td>
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<tr>
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<td>- implement innovative professional activities effectively and independently</td>
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<td>Reader's advisory</td>
<td>As announced in course</td>
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<td>Language of instruction</td>
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<td>Duration (semesters)</td>
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<td>Vorkenntnisse / Previous knowledge</td>
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<table>
<thead>
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### Module Information

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

**Module code**
inf485

**Credit points**
6.0 KP

**Workload**
180 h

**Used in course of study**
- Master Informatik > Theoretische Informatik

**Contact person**
Module responsibility
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

**Entry requirements**

**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

**Reader's advisory**
As announced in course

**Language of instruction**
German

**Duration (semesters)**
1 Semester

**Module frequency**
unregelmäßig

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Moduleart**
je nach Studiengang Pflicht oder Wahlpflicht

**Lern-Lehrform / Type of program**
2 courses out of V, S, Ü, P, PR

**Vorkenntnisse / Previous knowledge**

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</table>
inf486 - CurrentTopics in 'Correct Systems Design' I

Module label: CurrentTopics in 'Correct Systems Design' I

Module code: inf486

Credit points: 3.0 KP

Workload: 90 h

Used in course of study: Master Informatik > Theoretische Informatik

Contact person:

Module responsibility:
- Hans Fleischhack
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Authorized examiners:
- Hans Fleischhack
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Entry requirements:

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 convincingy

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

Reader's advisory

As announced in course

Links

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modullevel: AS (Akzentsetzung / Accentuation)

Modulart: je nach Studiengang Pflicht oder Wahlpflicht
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inf487 - Current Topics in 'Correct Systems Design' II

Module label | Current Topics in 'Correct Systems Design' II
Module code | inf487
Credit points | 3.0 KP
Workload | 90 h
Used in course of study | Master Informatik > Theoretische Informatik

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

Entry requirements
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

Reader's advisory
As announced in course

Links
Language of instruction | German
Duration (semesters) | 1 Semester
Module frequency | unregelmäßig
Module capacity | unlimited
Modullevel | AS (Akzentsetzung)
Modulart | Wahlpflicht
Lern-/Lehrform / Type of program | S or V
Vorkenntnisse / Previous knowledge
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Course type: Course or seminar

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inf488 - Special Topics in 'Formal Languages' I

Module label Special Topics in 'Formal Languages' I
Module code inf488
Credit points 6.0 KP
Workload 180 h

Used in course of study
- Master Informatik > Theoretische Informatik

Contact person
Module responsibility
- Annegret Habel
- Die im Modul Lehrenden

Authorized examiners
- Annegret Habel
- Die im Modul Lehrenden

Entry requirements
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

Reader’s advisory
As announced in course

Links

Language of instruction German
Duration (semesters) 1 Semester
Module frequency unregelmäßig
Module capacity unlimited
Modullevel AS (Akzentsetzung / Accentuation)
Modulart je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program 2 courses out of V, S, Ü, P, PR
Vorkenntnisse / Previous knowledge
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**Course type**: Course selection

**SWS**: 2.00

**Frequency**: WiSe

**Workload attendance**: 28 h
inf489 - Special Topics in 'Formal Languages' II

Module label: Special Topics in 'Formal Languages' II
Module code: inf489
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Informatik > Theoretische Informatik

Contact person:
Module responsibility:
- Michael Sonnenschein
- Annegret Habel

Module counseling:
- Die im Modul Lehrenden

Entry requirements:

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

Reader's advisory:
As announced in course

Links:

Language of instruction: German
Duration (semesters): 1 Semester
Module frequency: unregelmäßig
Module capacity: unlimited
Modulelevel: ---
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program: 2 courses out of V, S, Ü, P, PR

Vorkenntnisse / Previous knowledge:

Examination:

Time of examination:

Type of examination:

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- **Course type**: Course selection
- **SWS**: 2.00
- **Frequency**: WiSe
- **Workload attendance**: 28 h
inf490 - Current Topics in 'Formal Languages' I

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<p>| Module contents | See assigned course description |
| Reader's advisory | As announced in course |
| Links | |
| Language of instruction | German |
| Duration (semesters) | 1 Semester |
| Module frequency | halbjährlich |
| Module capacity | unlimited |
| Modullevel | AS (Akzentsetzung / Accentuation) |
| Modulart | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program | S or V |
| Vorkenntnisse / Previous knowledge | |</p>
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inf491 - Current Topics in 'Formal Languages' II

Module label Current Topics in 'Formal Languages' II
Module code inf491
Credit points 3.0 KP
Workload 90 h

Used in course of study
• Master Informatik > Theoretische Informatik

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

Entry requirements

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

Reader’s advisory
As announced in course

Links

Language of instruction German
Duration (semesters) 1 Semester
Module frequency unregelmäßig
Module capacity unlimited
Modullevel AS (Akzentsetzung / Accentuation)
Modulart je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program S oder V
Vorkenntnisse / Previous knowledge
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inf494 - Current Topics in 'Modeling and Analysis of Complex Systems' I

Module label Current Topics in 'Modeling and Analysis of Complex Systems' I
Module code inf494
Credit points 3.0 KP
Workload 90 h
Used in course of study • Master Informatik > Theoretische Informatik

Contact person

Module responsibility

- Sibylle Fröschle
- Die im Modul Lehrenden

Authorized examiners

- Sibylle Fröschle
- Die im Modul Lehrenden

Entry requirements

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“

Reader’s advisory

As announced in course

Links

Language of instruction German
Duration (semesters) 1 Semester
Module frequency unregelmäßig
Module capacity unlimited
Modulelevel AS (Akzentsetzung / Accentuation)
Modulart je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program S or V
Vorkenntnisse / Previous knowledge
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inf495 - Current Topics in 'Modeling and Analysis of Complex Systems' II

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**Contact person**

Module responsibility
- Sebastian Lehnhoff
- Sibylle Fröschle
- Die im Modul Lehrenden

Authorized examiners
- Sebastian Lehnhoff
- Sibylle Fröschle
- Die im Modul Lehrenden

**Entry requirements**

**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“

**Reader's advisory**

As announced in course

**Links**

Language of instruction: German

Duration (semesters): 1 Semester

Module frequency: unregelmäßig

Module capacity: unlimited

Modullevel: AS (Akzentsetzung / Accentuation)

Modulart: je nach Studiengang Pflicht oder Wahlpflicht
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**Nicht Informatik**

inf305 - Medical Technology

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**Used in course of study**

- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Nicht Informatik
- Master Informatik > Technische Informatik

**Contact person**

- Module responsibility
  - Andreas Hein
- Authorized examiners
  - Andreas Hein
  - Die im Modul Lehrenden

**Entry requirements**

**Skills to be acquired in this module**

**Professional competence**

The students:

- 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).

**Reader's advisory**

- Lecture slides
recommended:


secondary literature:


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<td>Lern-/Lehrform / Type of program</td>
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| Vorkenntnisse / Previous knowledge | - Signal and Image Processing  
- Control Engineering |

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<td>1.00</td>
<td>WiSe</td>
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Total time of attendance for the module: 56 h
inf307 - Robotics

Module label  Robotics
Module code  inf307
Credit points  6.0 KP
Workload  180 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Informatik > Nicht Informatik
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Andreas Hein
- Die im Modul Lehrenden

Authorized examiners
- Die im Modul Lehrenden
- Andreas Hein

Entry requirements

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

**Reader's advisory**

**essential:**
lecture nodes

**recommended:**

**sekondary literature:**

**Links**

**Languages of instruction**
German, English

**Duration (semesters)**
1 Semester

**Module frequency**
onece a year

**Module capacity**
unlimited

**Modullevel**
AS (Akzentsetzung / Accentuation)

**Modulart**
Pflicht o. Wahlpflicht / compulsory or optional

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

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Course type**

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<td>Exercises</td>
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**Total time of attendance for the module**
56 h
inf308 - Microrobotics II

Module label | Microrobotics II
---|---
Module code | inf308
Credit points | 6.0 KP
Workload | 180 h

Used in course of study
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodul
- Master Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master Engineering of Socio-Technical Systems > Systems Engineering
- Master Engineering Physics > Schwerpunkt: Laser und Optik
- Master Informatik > Nicht Informatik
- Master Informatik > Technische Informatik

Contact person
Module responsibility
- Sergej Fatikow
- Die im Modul Lehrenden

Authorized examiners
- Sergej Fatikow
- Die im Modul Lehrenden

Entry requirements
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 microrobots

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

Reader's advisory
- Lecture notes (can be obtained in secretariate, A1-3-303)
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| Total time of attendance for the module | 56 h |
**inf524 - Introduction to Medicine for Computer Science Students**

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**Used in course of study**
- Master Informatik > Angewandte Informatik
- Master Informatik > Nicht Informatik

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

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- ---

**Module capacity**
- unlimited

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

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

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Course type**

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**Total time of attendance for the module**
- 56 h
inf950 - Interdisciplinary Module I

Module label: Interdisciplinary Module I
Module code: inf950
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule
- Master Informatik > Nicht Informatik

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

Entry requirements
Skills to be acquired in this module
Module contents
Reader's advisory
Links
Languages of instruction
Duration (semesters): 1 Semester
Module frequency
Module capacity: unlimited
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge
Examination
Time of examination
Type of examination
Final exam of module: M

Course type: Course selection

SWS: 2.00
Frequency: WiSe
Workload attendance: 28 h
### inf951 - Interdisciplinary Module II

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| Used in course of study | Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule  
  Master Informatik > Nicht Informatik |
| Contact person          |                             |
| Entry requirements      |                             |
| Skills to be acquired in this module |                   |
| Module contents         |                             |
| Reader's advisory       |                             |
| Links                   |                             |
| Languages of instruction|                             |
| Duration (semesters)    | 1 Semester                  |
| Module frequency        |                             |
| Module capacity         | unlimited                   |
| Modullevel              | ---                         |
| Modultart               | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program |               |
| Vorkenntnisse / Previous knowledge |                     |
| Examination             |                             |
| Time of examination     |                             |
| Type of examination     |                             |
| Final exam of module    |                             |
| Course type             |                             |
| SWS                     | Course selection            |
| Frequency               | 2.00                        |
| Frequency               | WiSe                       |
| Workload attendance     | 28 h                        |

**Notes:**
- This module is used in the course of study Master Eingebettete Systeme und Mikrorobotik > Akzentsetzungsmodule and Master Informatik > Nicht Informatik.
- The module frequency varies depending on the study programme, being either mandatory or elective.
- The examination is a final exam of the module. The type of examination is M (course selection).
- The SWS (Semesterwochenstunden) is 2.00.
- The frequency is WiSe (Wintersemester).
- The workload attendance is 28 hours.
## mat996 - Introduction to Numerical Analysis

<table>
<thead>
<tr>
<th>Module label</th>
<th>Introduction to Numerical Analysis</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>mat996</td>
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<tr>
<td>Credit points</td>
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<tr>
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<td></td>
<td>Fach-Bachelor Informatik &gt; Wahlpflichtbereich Mathematik</td>
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<td></td>
<td>Fach-Bachelor Wirtschaftsinformatik &gt; Aufbaumodule</td>
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<td>Master Informatik &gt; Nicht Informatik</td>
</tr>
<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Alexey Chernov</td>
</tr>
<tr>
<td></td>
<td>Frank Schöpfer</td>
</tr>
</tbody>
</table>

### Entry requirements

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

### Skills to be acquired in this module

**Professional competence**
- learn basic numerical methods and algorithms
- analyze properties of the numerical methods using rigorous mathematical tools
- implement the basic numerical methods in a computer program
- interpret results of computer simulations

**Methodological competence**
- analyze algorithms with mathematical tools
- implement numerical algorithms for concrete problems

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

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

### Module contents

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

### Reader's advisory


### Links

**Language of instruction**
- German

**Duration (semesters)**
- 1 Semester

**Module frequency**
- every year

**Module capacity**
- unlimited

**Modullevel**
- AS (Akzentsetzung / Accentuation)

**Modulart**
- Wahlpflicht / Elective

**Lern-/Lehrform / Type of program**
- Analysis I, Lineare Algebra

**Vorkenntnisse / Previous knowledge**
- Time of examination
- Type of examination
- Final exam of module

**Course type**
- Comment
- SWS
- Frequency
- Workload attendance
<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
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<td>Exercises</td>
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**Total time of attendance for the module**

56 h
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<thead>
<tr>
<th><strong>mat997 - Introduction to Probability and Statistics</strong></th>
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<tbody>
<tr>
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<tr>
<td><strong>Credit points</strong></td>
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<tr>
<td><strong>Workload</strong></td>
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<td><strong>Used in course of study</strong></td>
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<tr>
<td><strong>Contact person</strong></td>
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<tr>
<td><strong>Entry requirements</strong></td>
</tr>
<tr>
<td><strong>Skills to be acquired in this module</strong></td>
</tr>
<tr>
<td><strong>Module contents</strong></td>
</tr>
<tr>
<td><strong>Reader's advisory</strong></td>
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<td><strong>Language of instruction</strong></td>
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<td><strong>Duration (semesters)</strong></td>
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<tr>
<td><strong>Module frequency</strong></td>
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<td><strong>Module capacity</strong></td>
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<td><strong>Modulart</strong></td>
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<td><strong>Lern-/Lehrform / Type of program</strong></td>
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<td><strong>Examination</strong></td>
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<td><strong>Course type</strong></td>
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<tr>
<td>Lecture</td>
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<td>Exercises</td>
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</table>
Abschlussmodul

mam - Master Thesis and Colloquium

<table>
<thead>
<tr>
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<th>Master Thesis and Colloquium</th>
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</tbody>
</table>

Contact person

- Michael Sonnenschein
- Andreas Hein
- Die im Modul Lehrenden

Module counseling

- Die im Modul Lehrenden

Entry requirements

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 data models
- 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

<table>
<thead>
<tr>
<th>Module contents</th>
<th>Independently researched scientific work. The research findings will be presented and discussed in a master’s thesis colloquium.</th>
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</thead>
<tbody>
<tr>
<td>Reader's advisory</td>
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<td>Links</td>
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<td>Master’s thesis, presentation and discussion.</td>
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