Modulhandbuch

Computing Science - Master of Education Programme (Gymnasium)

im Summer semester 2024

erstellt am 04/05/24

Pflichtmodule

inf401 - Foundations of Theoretical Computer Science

Module label	Foundations of Theoretical Computer Science
Modulkürzel	inf401
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule • Bachelor's Programme Mathematics (Bachelor) > Nebenfachmodule • Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP) • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule • Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule • Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	• Wehrheim, Heike (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirement
Skills to be acquired in this module	Introduction to the theory of automata, formal languages, computability, and complexity **Professional competence** The students: • know different classes of languages (e.g. regular and context-free languages) • know automata models corresponding to the respective language classes (e.g. finite automata, pushdown automata, Turing machines) • construct automata, Turing machines, and grammars for given tasks • know equivalent formalisations of the concept of algorithm • classify functions as algorithmically computable and problems as algorithmically decidable • know and recognize undecidable problems • evaluate the complexity of algorithms • know problems that are solvable deterministically or nondeterministically in polynomial time **Methodological competence** The students: • learn about the power of abstract models of computation **Social competence** The students: • work together in small groups to solve problems • present solutions to problems to groups of other students **Self-competence** The students: • learn persistence in pursuing difficult tasks • learn precision in writing down solutions
Module contents	In the first part of the course, different classes of languages are introduced (regular and context-free languages). For each class a matching automata model is presented (finite automata, pushdown automata). Various properties are proven for the introduced classes of languages and models of automata. In the second part of the course, we examine which functions are computable and which problems are decidable. To this end, the concept of algorithm is formalised. Turing machines and grammars turn out as equivalent approaches. We show that there are problems that are undecidable. Many of these problems are of practical interest. The third part of the course deals with the complexity of algorithms, i.e. how much time and space is required to solve a problem. In particular, we consider problems that are solvable in polynomial

time, either deterministically or non-deterministically. These problems are classified as P and NP.

Literaturempfehlungen	**Essential:**
	Skript "Grundbegriffe der Theoretischen Informatik", jeweils in aktueller Ausgabe
	Recommended:
	Schöning: "Theoretische Informatik kurzgefasst", 5. Auflage, Spektrum, 2008
	Good secondary literature:
	Hopcroft, Motwani, Ullman: "Einführung in die Automatentheorie, Formale Sprachen und Komplexitätstheorie", Pearson, 2002 (ein Klassiker...)

Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	none

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	WiSe	42
Exercises		1	WiSe	14
Präsenzzeit Modul insgesamt				56 h

inf420 - Introduction to IT-Security

Module label	Introduction to IT-Security
Modulkürzel	inf420
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich - Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen	- Peter, Andreas (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirements
Skills to be acquired in this module	

Students understand the basic concepts, methods and protocols for protecting data and systems from manipulation and misuse on a basic, practice-oriented, scientific level (see "contents of the module"). The students can explain the causes of security problems in today's systems, can reproduce the connections between protection mechanisms and the problems they address, and can apply them to case studies. They can identify vulnerabilities, analyze them and understand the attack mechanisms described. In addition, the students are able to discuss possible solutions and are able to protect systems accordingly.

Professional competence
The students

- understand the semantics of security and explain the properties of secure IT systems (see "contents of the module"),
- discuss the importance of IT security, and
- carry out simple security analyses of systems.

Methological competence

The students

- use concepts and techniques to increase security, in particular regarding which protection goals can be achieved with which techniques (see "contents of the module"),
- apply mechanisms of IT security in simple scenarios, and
- question the properties and limits of security concepts and combine different concepts in a meaningful way.

Social competence

The students

- solve problems partially in small groups and thus improve their willingness to cooperate and their communication skills,
- present solutions to IT security problems in front of the exercise group,
- discuss their different solutions within the exercise group, and
- improve their English language skills.

Self-competence
The students

- motivate themselves to work on questions and problems in the domain of IT security,
- justify their own actions with theoretical and methodical knowledge, and
- critically reflect on proposed solutions in relation to social expectations

and consequences, taking into account the methods taught.

Module contents

The course provides a broad introduction to IT security, covering the following topics:

- basic terms, concepts, and principles in IT security,
- major cryptographic building blocks (encryption, signatures, ...),
- access control models and mechanisms,
- authentication and key exchange protocols,
- network security basics,
- anonymous communication (including TOR), and
- basics of privacy protection.

Literaturempfehlungen

- C. Eckert. IT-Sicherheit: Konzepte – Verfahren – Protokolle. 10th edition. De Gruyter Oldenbourg, ISBN 978-3-110-58468-4, 2018
- P. van Oorschot. Computer Security and the Internet. 2nd edition. Springer, ISBN 978-3-030-83410-4, 2021
- R. Anderson. Security Engineering: A Guide to Building Dependable Distributed Systems. 2nd edition. Wiley, ISBN 978-0470068526, 2008

Links

Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	Every winter semester
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	Hard requirement: Fundamental knowledge on algorithms, discrete structures, and linear algebra as for instance covered in the following courses at the UOL: • inf030 Programmierung, Datenstrukturen und Algorithmen • mat950 Diskrete Strukturen • mat955 Linear Algebra für Informatik Useful (but optional) additional knowledge: Basics of computer networks as for instance covered in the UOL course inf010 Rechnernetze

Examination	Prüfungszeiten	Type of examination
Final exam of module		
		Written or oral exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	2
Exercises		2	WiSe	2
Präsenzzeit Modul insgesamt				4 h

inf701 - Computer Science Education II

Module label	Computer Science Education II
Modulkürzel	inf701
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Pflichtbereich - Master's Programme Computing Science (Master) > Angewandte Informatik
Zuständige Personen	- Diethelm, Ira (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirements
Skills to be acquired in this module	Professional competence The students: (re-)construct the knowledge of computer science by the method of didactical reduction - differentiate the development of computer science and evaluate this development with current trends for class - select computer science education approaches for lesson planning, organisation and implementation **Methodological competence** The students: (re-)construct core concepts of lesson planning for computer science education requirements **Social competence** The students: - present self-developed lesson plans and lesson materials - discuss lesson plans regarding computer science education concepts - accept opinions and criticism - provide constructive feedback **Self-competence** The students: - adapt computer science education concepts for lesson planning - reflect on their self-perception with regard to the conception of computer science education
Module contents	The lecture will focus on the requirements and challenges of computer science education in grammar school (German: Gymnasium). **Main focus:** - Didactical (re-)construction of computer science knowledge, especially its didactical reduction - Didactical categorisation of computer science and the development, importance and evaluation of computer science in school - Scheduling, organisation and implementation of computer science in class
Literaturempfehlungen	Humbert, Ludger: Didaktik der Informatik. Wiesbaden: B. G. Teubner,

2005
- Weitere Literatur wird in der Veranstaltung je nach thematischen Schwerpunkten bekannt gegeben

Links	<!HTML>http://elearning.uni-oldenburg.de
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	S
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module		
	End of lecture period	Exercise and und 1 seminar paper or 1 oral exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	56
Exercises		2	WiSe	0
Präsenzzeit Modul insgesamt				56 h

inf704 - Computer Science Education III

Module label	Computer Science Education III
Modulkürzel	inf704
Credit points	3.0 KP
Workload	90 h
Verwendbarkeit des Moduls	• Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule • Master's Programme Computing Science (Master) > Angewandte Informatik
Zuständige Personen	• Diethelm, Ira (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

no participant requirements

Skills to be acquired in this module

The students should know research methodical approaches of computer science didactics and be able to apply them exemplarily. They should be able to examine and further develop subject-specific didactic approaches in a well-founded manner and describe the corresponding effects on content, methods and tools of teaching.

Professional competences
The students:

- characterize research methodological approaches in computer science didactics
- investigate an exemplary research question, with the help of research methods of computer science didactics
- differentiate approaches of computer science didactics and their impact on content, methods and tools of teaching

Methodological competences
The students:

- transfer the presented research methods to new questions and adapt them appropriately to develop theories,
- formulate hypotheses for research in the classroom and test them

Social competences
The students:

- discuss in groups the research methods presented
- present research methods they have used and accept criticism or give professional critique

Self-competences
The students:

- incorporate the research methods presented into their actions in order to test their hypotheses
- reflect on their self-image as a researcher in the field of subject didactics

Module contents

The course will address:

- research methodological approaches in computer science didactics
- possibilities of theory-based development of concrete teaching scenarios
- approaches to the evaluation of computer science education and computer science didactics concepts

Literaturempfehlungen

- Humbert, Ludger: Didaktik der Informatik. Wiesbaden: B. G. Teubner,

2005.
* Further literature will be announced in the lecture.

Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited
Teaching/Learning method	S
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module		
		Presentation or practical exercises or oral examination

Lehrveranstaltungsform	Seminar
SWS	2
Frequency	SoSe oder WiSe
Workload Präsenzzeit	28 h

inf712 - Current Topics in Computer Science Education I

Module label	Current Topics in Computer Science Education I
Modulkürzel	inf712
Credit points	3.0 KP
Workload	90 h
Verwendbarkeit des Moduls	• Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule • Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Pflichtbereich • Master's Programme Computing Science (Master) > Angewandte Informatik
Zuständige Personen	• Diethelm, Ira (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

No participant 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

Literaturempfehlungen

As announced in course

Links

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	irregular
Module capacity	unlimited
Teaching/Learning method	V or S
Previous knowledge	none

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

Lehrveranstaltungsform	Course or seminar
SWS	2
Frequency	siehe Angebotsrhythmus Modul
Workload Präsenzzeit	28 h

inf851 - Computer Science and Society

Module label	Computer Science and Society
Modulkürzel	inf851
Credit points	6.0 KP
Workload	180 h

Verwendbarkeit des Moduls

- Bachelor's Programme Biology (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Business Administration and Law (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Business Informatics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Bachelor's Programme Chemistry (Bachelor) > Säule "Überfachliche Professionalisierung" more...
- Bachelor's Programme Comparative and European Law (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Computing Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Computing Science (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft
- Bachelor's Programme Economics and Business Administration (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik
- Bachelor's Programme Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Engineering Physics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Environmental Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Physics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Social Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Bachelor's Programme Sustainability Economics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Biology (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme General Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme History (Bachelor) > Säule "Überfachliche Professionalisierung"

- Dual-subject bachelor's programme Low German (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Music (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Physics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > Säule "Überfachliche Professionalisierung"
- Dual-Subject Bachelor's Programme Technology (Bachelor) > Säule "Überfachliche Professionalisierung"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > Säule "Überfachliche Professionalisierung"
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule
- Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Recht und Gesellschaft

Zuständige Personen	
	• Lehrenden, Die im Modul (Prüfungsberechtigt)
	• Dittert, Nadine (module responsibility)

Prerequisites	no participant requirements

Skills to be acquired in this module	Graduates of the module Informatik und Gesellschaft know the history of the development of Information technology and its impact on society and are familiar with issues of data protection. They will be able, individually or in a team, to analyze the ethical and socio-political implications of different areas and applications of computer science and develop a reasoned own position on this, in particular concerning their professional responsibilities as computer scientists. They have learned to present the results of their work convincingly and suitable for their target group using appropriate media and they are able to organize events such as workshops or small conferences for that purpose.

Professional competence
The students:

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

Methodological competence
The students:

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

Social competence
The students:

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

Self-competence
The students:

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

Module contents	In brief, topics like the following are covered:

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

Literaturempfehlungen

- See reference books Informatik und Gesellschaft in BIS.
- Joseph Weizenbaum, 2001: Die Macht der Computer und die Ohnmacht der Vernunft.
- H. Klaeren u.a., (Eds.), 1999: Tübinger Studientexte Informatik und Gesellschaft. Universität Tübingen.
- J. Friedrich, Th. Herrmann, M. Peschek, A. Rolf (Hrsg.),1995: Informatik und Gesellschaft. Spektrum.

Links	https://uol.de/iug
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Reference text	The topics for the teams are assigned during the first week of the semester
Teaching/Learning method	1VL + 1S
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module	During semester and at the end	Portfolio (5-6 partial performances)

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Seminar		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

wir806 - Information Technology Law

Module label	Information Technology Law
Modulkürzel	wir806
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft - Bachelor's Programme Computing Science (Bachelor) > Wahlbereich Informatik, Kultur und Gesellschaft - Master Applied Economics and Data Science (Master) > Specialization - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule - Master of Education Programme (Hauptschule und Realschule) Computing Science (Master of Education) > Mastermodule more... - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Recht und Gesellschaft - Master's programme Business Administration: Management and Law (Master) > Basismodule - Master's programme Business Administration: Management and Law (Master) > Schwerpunktmodule RdW - Recht - Master's Programme Business Informatics (Master) > Module der Wirtschafts- und Rechtswissenschaften (Master) - Master's Programme Computing Science (Master) > Module aus anderen Studiengängen
Zuständige Personen	- Rott, Peter (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt) - Rott, Peter (Module counselling)
Prerequisites	not applicable
Skills to be acquired in this module	The students are familiar with the effects of digitalisation with its chances and risks in European and German private law and, in particular, consumer law. They obtain knowledge of specific areas of digitalised private law and consumer law with particular relevance for their future professional practice, are able to solve consumer law cases in a goal-oriented way, are able to find approaches for legal problems as well as recognise liability risks and how to deal with them, and are, in contract negotiations, able to recognise the requirements for regulation and to evaluate its consequences
Module contents	This module conveys how new technologies impact on private law and, in particular, on consumer law. It focuses on the (modified) interpretation of existing laws but even more on the reactions of the EU and national legislators and of the judiciary to new technological developments. The module discusses, among others, distance selling law, digitalised sales law and product liability law, the law of digital content and digital services, unfair commercial practices on internet and the law of the platform economy. Finally, the module looks at enforcement.
Literaturempfehlungen	to be announced in the first lecture
Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited
Type of module	Wahlpflicht / Elective
Module level	MM (Mastermodul / Master module)
Teaching/Learning method	Lecture and Seminar
Previous knowledge	basic knowledge of civil law is helpful.

Examination	Prüfungszeiten	Type of examination
Final exam of module		to be taken from the examination regulations

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2		28
Seminar		2		28
Präsenzzeit Modul insgesamt				56 h

Abschlussmodul

mam - Master Thesis and Colloquium

Module label	Master Thesis and Colloquium
Modulkürzel	mam
Credit points	27.0 KP
Workload	810 h
Verwendbarkeit des Moduls	• Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Abschlussmodul
Zuständige Personen	• Diethelm, Ira (module responsibility) • der Informatik, Lehrende (Module counselling) • Lehrenden, Die im Modul (Module counselling)
Prerequisites	no participant 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 masters 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 masters thesis is finished by a colloquium.

Professional competence
The students:

- recognise and evaluate applied techniques and methods of their subject and are aware of their limits
- design solutions for complex, possibly vaguely defined or unusual computer science tasks/problems and evaluate these with reference to state of the art computer science and technology
- identify, structure and solve problems/tasks, also in new or developing subject areas
- apply state of the art and innovative methods to solve problems, if necessary from other disciplines
- relate knowledge from different disciplines and apply this new knowledge in complex situations
- develop complex computer systems, processes and datamodels
- are aware of the current limits and contribute to the development of computer science research and technology
- discuss and evaluate recent computer science developments

Methodological competence
The students:

- identify and develop one or more solutions
- evaluate and apply tools, technology and methods sophisticatedly
- examine tasks with technical and research literature, write an academic article and present their solutions academically
- schedule processes and resources
- apply project management techniques
- combine new and original approaches and methods creatively
- evaluate problems/tasks, including new or developing subject areas of their discipline and apply computer science methods for solutions and research

Social competence
The students:

- communicate with users and experts convincingly
- take reasonable decisions

Self-competence
The students:

- pursue the overall and special computer science development critically
- implement innovative professional activities effectively and independently
- recognise their abilities and extend them purposefully
- reflect their self-perception and actions with regard to professional, methodological and social aspects

- develop and reflect self-developed hypothesis to theories independently
- work in their field independently

Module contents		The content of this module is an independent topic research. The research findings will be presented and discussed in a masters thesis colloquium.
Literaturempfehlungen		Wird entsprechend des konkreten Themas spezifiziert
Links		
Languages of instruction		German, English
Duration (semesters)		1 Semester
Module frequency		halbjährlich
Module capacity		unlimited
Teaching/Learning method		1S
Previous knowledge		none
Examination	Prüfungszeiten	Type of examination
Final exam of module		Masterthesis, presentation and discussion
Lehrveranstaltungsform	Seminar	
SWS	2	
Frequency	SoSe und WiSe	
Workload Präsenzzeit	28 h	

Wahlpflichtmodule (Praktische Informatik)

inf006 - Software Engineering II

Module label	Software Engineering II
Modulkürzel	inf006
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik - Master's Programme Computing Science (Master) > Praktische Informatik - Master's Programme Environmental Modelling (Master) > Mastermodule
Zuständige Personen	- Winter, Andreas (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Softwaretechnik I
Skills to be acquired in this module	The objective of the module inf006 Software Engineering II is to deepen the subjects and skills of the module Software Engineering I. Special software engineering topics will be presented, deepened and discussed. The lecture deals with different software engineering methods and technology which will be discussed in the seminar. The discussions are contextualised by scientific research projects, practical projects and latest research findings. **Professional competence** The students: - deepen software engineering methods and techniques - use specific software engineering methods and techniques - differentiate developmental techniques of software systems - discuss software engineering topics - design software systems by using appropriate methods - solve software engineering problems independently - reflect self-designed software engineering solutions critically and present them appropriately **Methodological competence** The Students: - structure problems with modelling techniques - develop actual methods of software engineering - present software engineering solutions - write scientific papers independently **Social competence** The Students: - explain and discuss software development solutions in their practical use - accept criticism and see it as an asset **Self-competence** The Students: - reflect their problem-solving behaviour with regard to the possibilities of software technology - internalize the presented developmental methods and integrate them in their own actions
Module contents	**The following subjects are provided**: - Concept of systems - Iterative and agile process models of software development

- System development and cost estimation
- Methods, techniques and tools to collect requirements
- Techniques to develop and describe software architecture
- Measurement and evaluation of software systems
- Extended techniques of modelling, meta-modelling, domain specific languages - Model based development
- Methods and techniques of software evolution

Literaturempfehlungen

- Ian Sommerville: Software Engineering, Addison-Wesley Longman, Amsterdam, 10. Ed. 2012
- Jochen Ludewig, Horst Lichter: Software Engineering, dpunkt.verlag, 3. Auflage 2013
- Helmut Balzert: Lehrbuch der Software-Technik, Spektrum Akademischer Verlag, 3. Auflage 2009
- Chris Rupp, Stefan Queins: UML 2 glasklar. Praxiswissen für die UML-Modellierung, Carl Hanser Verlag, 4. Auflage 2012
- and actual papers from IEEE Software, IEEE Transactions on Software-Engineering, Informatik-Spektrum and conferences (z.B. ICSE, ICSM, WCRE, CSMR, ICPC, SLE, u.a.)

Links

Language of instruction	German	
Duration (semesters)	1 Semester	
Module frequency	every summer term	
Module capacity	unlimited	
Teaching/Learning method	V+S	
Previous knowledge	Software engineering I	

Examination	Prüfungszeiten	Type of examination
Final exam of module	At the end of the lecture period	Portfolio (30-minute presentation, 1 paper (4 pages, IEEE) and oral exam)

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Seminar		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf008 - Information Systems II

Module label	Information Systems II
Modulkürzel	inf008
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik - Master Applied Economics and Data Science (Master) > Specialization - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik
Zuständige Personen	- Grawunder, Marco (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirement
Skills to be acquired in this module	The Module Information Systems II enhances the knowledge and the concepts of Information Systems I. **Professional competence** The students: - know further concepts, languages and architectures of databases - analyse advanced information processing tasks - analyse complex requirements of information systems appropriately - realize information requirements and gather relevant information **Methodological competence** The students: - propose concrete processing principles for special application classes - reflect specific technologies' consequences and proceedings **Social competence** The students: - improve their ability to work in a team **Self-competence** The students: - reflect their problem-solving behaviour with regard to extended information processing concepts
Module contents	- Implementation of databases (architecture, index structures, query processing and optimization) - Data integration and data analysis (data integration, data warehouses, data mining) - Information retrieval - Parallel databases
Literaturempfehlungen	Suggested reading: - Härder, T.,Rahm, E.:Datenbanksysteme -Konzepte und Techniken der Implementierung, Morgan Kaufmann - Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, McGraw-Hill U. Leser, F. Naumann. Informationsintegration: Architekturen und Methoden zur Integration verteilter und heterogener Datenquellen. dpunkt - Bauer/Günzel. Data-Warehouse-Systeme, dpunkt - Han/Kamber/Pei. Data Mining: Concepts and Techniques, Morgan Kaufmann

Links

Language of instruction		German		
Duration (semesters)		1 Semester		
Module frequency		annual		
Module capacity		unlimited		
Teaching/Learning method		V+Ü		
Previous knowledge		none		

Examination	Prüfungszeiten	Type of examination
Final exam of module	At the end of the lecture period	written or oral Exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	SoSe	42
Exercises		1	SoSe	14
Präsenzzeit Modul insgesamt				56 h

inf009 - Database Practical

Module label	Database Practical
Modulkürzel	inf009
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Praktische Vertiefung (60 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Praktische Vertiefung der Informatik
Zuständige Personen	- Grawunder, Marco (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	- Information Systems I - Operating system knowledge
Skills to be acquired in this module	The objective of this module is to gather practical experience on databases and information systems. The students get an overview of the technical realisation, implementation and optimisation of a professional database management system. **Professional competence** The students: - Realise, implement and program data base systems - Program and implement database-oriented system routines - Implement optimisation goals in the modelling phase - Administer professional database systems (installation, maintenance and adjustment) - Recognise database systems' performance problems and are able to fix them with according methods - Organise and control processes of database systems **Methodological competence** The students: - propose concrete processing principles for special application classes - reflect on specific technologies and procedures with regard to their consequences **Social competence** The students: - Solve database system problems in a team **Self-competence** The students: - Acknowledge the limits of their ability to cope with pressure during the implementation and are aware of failures - Reflect their self-perception
Module contents	The module "Practical Course Databases" is a related practical course of the module "Information Systems I". The objectives of this module are special technical concepts of a database system and practical solutions in database programming and optimisation. **Contents of this module are:** - System-oriented database management programming, - Implementation of catalogue systems,

- Optimisation strategies based on parallelisation and partitioning requirements

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Literaturempfehlungen

- Ramez Elmasri und Shamkant B. Navathe (2007). Fundamentals of Databases Systems. Fifth Edition, Pearson/Addison Wesley
- Held Andrea (2005), Oracle 10g Hochverfügbarkeit Addison-Wesley -
- Held Andrea (2015), Oracle 12c New Features Addison Wesley
- Feuerstein Steven, Pribyl Bill, Dawes Chip (2007).Oracle PL/SQL. 4. Auflage, O'Reillys Taschenbibliothek

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Links	http://www-is.informatik.uni-oldenburg.de/227/
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	every winter term
Module capacity	unlimited
Teaching/Learning method	P
Previous knowledge	Information Systems I Operating system knowledge

Examination	Prüfungszeiten	Type of examination
Final exam of module	At the end of the lecture period	Oral exam
Lehrveranstaltungsform	Exercises	

SWS	4
Frequency	WiSe
Workload Präsenzzeit	56 h

inf010 - Computer Networks

Module label	Computer Networks
Modulkürzel	inf010
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik • Bachelor's Programme Computing Science (Bachelor) > Wahlpflichtbereich Praktische Informatik • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) • Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule • Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	• Kramer, Oliver (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirement
Skills to be acquired in this module	**Professional competence** The students: • identify the layers of the ISO/OSI model • recognise the main concepts and algorithms of each IOS/OSI layer • assign technical processes to the layers • classify new technologies to the main concepts of the ISO/OSI model - Compare different methods and approaches of a layer (i.e. TCP and UDP) • characterise safety-critical aspects of each layer **Methodological competence** The students: • administer small networks • characterise safety-critical aspects of networks **Social competence** The students: • work on exercises in small teams **Self-competence** The students: • accept criticism • reflect on their proposed solutions, taking into account the methods taught
Module contents	Contents of this lecture (cf. suggested reading Tanenbaum and Wetherall): • Introduction to networks and the internet • Physical Layer • Data Link Layer • MAC Sub-Layer • Network Layer • Transport Layer • Session Layer • Presentation Layer • Application Layer • Technologies (Cable and Co) • Nyquist Shannon and Transmissions - CDMA • Hamming & CRC • Stop & wait, go back n, selective repeat • Aloha & CSMA • Ethernet technologies • Wifi • Paket switchen & Dijsktra • IP Adressing & Header • TCP • UDP • Buckets & TCP-Reno

- DNS
- Flask
- RSA & PGP
- Firewalls

Literaturempfehlungen

- lecture notes
- A. Tanenbaum & D. Wetherall: Computernetzwerke, Pearson Studiu, 5. Aufl. 2012

Links				
Language of instruction		German		
Duration (semesters)		1 Semester		
Module frequency		annual		
Module capacity		unlimited		
Teaching/Learning method		V+Ü		
Previous knowledge		none		
Examination		Prüfungszeiten	Type of examination	
Final exam of module		At the end of the lecture period	Written or oral exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	SoSe	42
Exercises		1	SoSe	14
Präsenzzeit Modul insgesamt				56 h

inf012 - Operating Systems I

Module label	Operating Systems I
Modulkürzel	inf012
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik - Bachelor's Programme Computing Science (Bachelor) > Wahlpflichtbereich Praktische Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik)
Zuständige Personen	- Theel, Oliver (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Useful prior knowledge: Study contents of the first year of the subject Bachelor of Computer Science or Business Informatics.
Skills to be acquired in this module	To gain knowledge of and capabilities in the design, the implementation, and the evaluation of operating systems. **Professional competence** The students: - develop an understanding of operating systems regarding terminology, structure, functionality, conception, central challenges and solutions - evaluate the performance of operating systems - are aware of the implementation problems of operating systems - realise and evaluate solutions of subproblems - comprehend and evaluate the functional connections between application systems and hardware - understand operating systems as a link between technical and applied computer science **Methodological competence** The students: - transfer concepts of implementations to other contexts - question different solutions wrt. properties **Social competence** The students: - solve problems in small teams - present their solutions to the members of the tutorial - discuss their different solutions with members of the tutorial **Self-competence** The students: - accept criticism - question their initial solutions in the light of newly learned methods
Module contents	**The contents of this module are:** 1. "Operating systems" definition and structure 2. Requirements of operation systems 3. Technical characteristics of related hardware 4. The need and implementation options of parallel processes 5. Cooperation of processes: communication and synchronisation (semaphores) 6. Memory management: virtual und non-virtual memory management 7. File management
Literaturempfehlungen	A. Tanenbaum (2009). Modern Operating Systems. 3rd edition, Prentice Hall W. Stallings (2012).Operating Systems. 7th edition, Prentice Hall
Links	
Language of instruction	German

Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Reference text	Linked to the modules:

- Operating Systems II (as a possible follow-up course)
- Distributed Operating Systems (as a possible specialization)
- Operating Systems Practicum

Teaching/Learning method	V+Ü
Previous knowledge	Useful prior knowledge: Study contents of the first year of the subject Bachelor of Computer Science or Business Informatics.

Examination	Prüfungszeiten	Type of examination	
Final exam of module	End of the lecture period	Written or oral exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf015 - Distributed Operating Systems

Module label	Distributed Operating Systems
Modulkürzel	inf015
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik)
Zuständige Personen	• Theel, Oliver (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Operating systems I
Skills to be acquired in this module	This module deals with the fundamentals of distributed operating systems. It gives an understanding of the terminology, structures, functions, conceptions, key problems and implementation concepts of distributed operating systems. **Professional competence** • The students: • evaluate the performance and functionality of distributed operating systems • are aware of the realisation problems of distributed operating systems • know and evaluate standard methods of solving problems in the context of distributed operating systems • use standard methods to solve problems in the context of distributed operating systems **Methodological competence** The students: • use standard methods of the distributed operating system domain to solve problems in other contexts • analyse and rank different solutions in the problem domain wrt. relevant properties **Social competence** The students: • solve problems in small teams • present their solutions to the members of the tutorial • duscuss their sdifferent solutions with members of the tutorial **Self competence** The students: • accept critcism • question their initial solutions in the light of newly learned methods
Module contents	**The contents of this module are:** 1. The historical development towards distributed operating systems 2. Models of distributed computer systems 3. Models of distributed operating systems 4. Design criteria of distributed operating systems 5. Interprocess communication (Computer Networks, Message Passing, Remote Procedure Call) 6. Memory management ◦ DSM 7. Process management ◦ Task allocation ◦ Load balancing ◦ Load distribution ◦ Process migration 8. Synchronisation ◦ Clocks ◦ Ordering of events ◦ Distributed mutual exclusion ◦ Distributed leader lection ◦ Deadlocks 9. Naming and locatisation of objects 10. Distributed file systems

11. Fault tolerance concepts

Literaturempfehlungen

- Chow and Johnson (1998): Distributed Operating Systems and Algorithms, Addison-Wesley
- Tanenbaum und van Steen (2007): Distributed Systems: Principles und Paradigms, 2nd edition, Pearson/Prentice Hall
- Singhal und Shivaratri (1996): Advanced Concepts in Operating Systems, McGraw-Hill
- Coulouris, Dollimore, Kindberg (2001): Distributed Systems: Concepts and Design, Addison-Wesley

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Links

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

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

Teaching/Learning method	V+Ü
Previous knowledge	Operating Systems I

Examination	Prüfungszeiten	Type of examination
Final exam of module	End of the lecture period	Training tasks, written exam or oral exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf016 - Internet Technologies

Module label	Internet Technologies
Modulkürzel	inf016
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum-Wahlbereich Praktische Informatik - Bachelor's Programme Computing Science (Bachelor) > Wahlpflichtbereich Praktische Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	- Boles, Dietrich (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Useful previous knowloedge: object-oriented programming
Skills to be acquired in this module	

The graduates of the module know the basic concepts and technologies of Internet and web applications. They can evaluate the capability of the concepts and technologies to design Internet-based applications. The students will apply these concepts and techniques in a project.

Professional competence
The students:

- Know basic concepts and technologies of the Internet and the web

Methodological competence
The students:

- Are able to use the techniques in projects

Social competence
The students:

- Implement web-based projects in a team

Self-competence
The students:

- Reflect their own capabilities to develop Internet-based applications

Module contents	The module deals with the basic development concepts of Internet-based applications. It covers relevant client technologies of web applications (HTML, CSS, JavaScript), server technologies (forms, servlets, PHP, databases) and technologies for client server communication (AJAX, WebSockets, Web services, Social-Media-APIs)). Additional topics are web design, Internet law, security and web search. The practical exercises of this module consist of the design, implementation and presentation of a comprehensive web application. The topics of the lecture will be applied and deepened in practice.
Literaturempfehlungen	list of links in the learning management system
Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	every summer term
Module capacity	unlimited
Reference text	
Teaching/Learning method	V+Ü
Previous knowledge	Useful previous knowloedge: object-oriented programming

Examination	Prüfungszeiten	Type of examination
Final exam of module	The presentation of partial results of the practical project takes place weekly during the exercises.	project and written exam or project and oral exam

Examination		Prüfungszeiten	Type of examination	
		Final delivery of the final project is one week after the end of the lecture period. The written exam or oral exam take place in the last week of the lecture period or the first week after the end of the lecture period. Any re-examinations take place at the end of the semester break. The exact timetable can be found in the learning management system.		

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf017 - Interactive Systems

Module label	Interactive Systems
Modulkürzel	inf017
Credit points	6.0 KP
Workload	180 h

Verwendbarkeit des Moduls

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

- Dual-Subject Bachelor's Programme General Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme History (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-subject bachelor's programme Low German (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Music (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Technology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik)

Zuständige Personen	- Boll-Westermann, Susanne (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirement

Skills to be acquired in this module

Professional competence
The students:

- can describe and explain an iterative process to develop interactive systems.
- can classify a method known from the lecture into that process
- name the basic concepts and characteristics of usable user interfaces
- name and explain established guidelines and heuristics of the user-centered design of interactive systems

Methodological competence:
The students:

- can name and explain methods for context of use and/or user requirements analysis.
- can name methods for the design and prototypical implementation of interactive systems and discuss their advantages and disadvantage.
- can explain established methods for usability testing.
- can evaluate a given user interface with regard to potential usability problems.

Social competence
The students:

- can present solutions to usability problems or results of an usability evaluation in the plenum.

Self competence
The students:

- can accept criticisms by their peer group as valuable contributions to

their solutions.

Module contents	The field of interactive systems deals with the tasks, concepts and technologies of human-computer interaction and its user-friendly and suitable design. The lecture is based on the so-called Human Centred Design Process and includes models of interaction between humans and their environment, iterative design, prototyping techniques, study and evaluation processes. Basic design principles, methods and tools are presented. Practical tasks complete the lecture.
Literaturempfehlungen	
	• Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale: Human Computer Interaction. • Bernhard Preim, Raimund Dachselt: Interaktive Systeme • Weitere Fachartikel, die in der Vorlesung vorgestellt werden

Links	https://uol.de/en/media-informatics/teaching/courses
Languages of instruction	German, English
Duration (semesters)	1 Semester
Module frequency	every winter term
Module capacity	40
Teaching/Learning method	V+Ü
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module	Individually, at the end of the lecture period	Project and oral Exam or project and written exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Project		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf018 - Media Processing

Module label	Media Processing
Modulkürzel	inf018
Credit points	6.0 KP
Workload	180 h

Verwendbarkeit des Moduls

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

- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme General Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme History (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-subject bachelor's programme Low German (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Music (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Physics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Dual-Subject Bachelor's Programme Technology (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > PP "Medieninformatik für Studierende musisch-künstlerischer Fächer"
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik)
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Praktische Vertiefung der Informatik
- Master's Programme Business Informatics (Master) > Akzentsetzungsmodule der Informatik

Zuständige Personen	- Boll-Westermann, Susanne (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Solid programming skills in Java and/or C++, practical informatics. Interest in media processing
Skills to be acquired in this module	The students can explain the basics of image processing and know which algorithms exist for the basic tasks in image processing and how these are applied. The students can apply basic methods of image processing they learned in the lecture to solve simple problems. **Professional compentence:** The students - can name basic characteristics of digital media - can explain the most common methods for encoding and compressing images, video and audio - can describe basic procedures for image enhancement, feature extraction, feature description, image analysis and image comprehension **Methodological competence:** The students - can recognize and evaluate image properties and decide for suitable image processing methods - can select existing software packages for simple image processing problems, as well as use and customize them for their specific task - can implement simple image and media processing functions in a higher programming language (e.g., C ++)

Social competence

The students:

- can plan, implement, and document a software project in team work
- can present the results of their work to an audience and adequately respond to criticism and questions

Self competence

The students:

- can accept and learn from mistakes made during the process of implementation

Module contents	The lecture covers the technologies of media processing. In particular, the lecture focuses on image processing chain from digital imaging, through image pre-/and postprocessing, and image storage to image analysis. In addition to compression techniques and color space theory (RGB, HSV, YUV, CIEXYZ, ...), the topics of the lecture include image enhancement, feature extraction, feature description, image analysis and image comprehension. The lecture furthermore discusses the encoding and analysis of video and audio.
Literaturempfehlungen	

- Wilhelm Burger und Mark James Burge. Digitale Bildverarbeitung: Eine Einführung mit Java und Image, J. Springer, 2006.
- Literatur im Handapparat der Abteilung in der Bibliothek.
- Linkliste im Lernmanagementsystem zu den einzelnen Themen der Vorlesung.

Links	https://uol.de/en/media-informatics/teaching/courses
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	every winter term
Module capacity	12
Reference text	
Teaching/Learning method	V+Ü
Previous knowledge	Solid programming skills in Java and/or C++, practical informatics. Interest in media processing

Examination	Prüfungszeiten	Type of examination
Final exam of module	The presentation of the practical project on a project day of all small groups takes place directly after the lecture period. The oral examination takes place in the first two weeks after the end of the lecture period. Any post-examinations will take place at the end of the lecture period. The exact schedule can be found on the department's web pages as well as the information in the learning management system Stud.IP.	Project and oral Exam or project and written exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf020 - Machine-oriented Programming

Module label	Machine-oriented Programming
Modulkürzel	inf020
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik)
Zuständige Personen	• Theel, Oliver (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Study contents of the first year of the subject Bachelor of Computer Science or Business Informatics
Skills to be acquired in this module	**Professional competence** The students: • Comprehend special concepts and methods of low-level programming of tightly • coupled computer systems in C and their translation into NASM assembly language • Design and implement programs in C independently and systematically translate them into a computer architecture-specific assembly language • Implement machine-oriented software with appropriate programming and compilation techniques and concepts • Recognize the relation of technical and practical computer science as well as the relations of high- and low-level programming **Methodological competence** The students: • understand aspects of the practical and theoretical computer science • understand the connection between high level language constructs and low level language constructs • ranslate C programs into NASM programs **Social competence** The students: • Solve problems in small teams • Present their solutions to the members of the tutorial • Discuss their different solutions with members of the tutorial **Self-competence** The students: • Accept criticism - Question their initial solutions in the light of newly learned methods
Module contents	• Application areas of machine-oriented programming • Concepts of the programming language C - Programming in C • Setup and structure of tightly-coupled computer systems • Intel processor architecture • Assembly languages, in particular NASM assembly language • Systematical translation of programs from C to NASM assembly language This module builds a bridge between technical and practical computer science aspects and high-level and machine-oriented programming. The knowledge and skills learned in this module are relevant for machine-oriented system programming, e.g. in realising operating systems and translations of programming languages.
Literaturempfehlungen	• D. Patterson und J. Hennessy (2007). Computer Organization and Design, 3rd Edition, Elsevier Inc. • B. Kernighan und D. Ritchie (1988) The C Programming Language, Second Edition, Prentice Hall, Inc. • Jeff Duntemann (2009): Assembly Language Step by Step, 3rd edition,

Wiley Publishing

Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Reference text	Associated with the modules: • Betriebssysteme I und II (as possible prerequisites) • Verteilte Betriebssysteme (as possible specialisation) • Betriebssysteme-Praktikum

Teaching/Learning method		V+Ü	
Previous knowledge		Study contents of the first year of the subject Bachelor of Computer Science or Business Informatics	

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf040 - Introduction to Data Science

Module label	Introduction to Data Science
Modulkürzel	inf040
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich - Master Applied Economics and Data Science (Master) > Data Science - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich - Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen	- Wingerath, Wolfram (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	

Basics of databases, Python programming and statistics

Skills to be acquired in this module

The module teaches fundamentals from the field of Data Science, covering purposes, challenges, and common best practices.

Professional competences

The students

- have knowledge of basic concepts, problems and solution approaches from the field of Data Science.
- are able to justify the choice of specific data analysis methods for a given problem
- include possible imponderables in the analysis when evaluating analysis results

Methological competences
The students

- are able to translate questions from a specific domain into a feasible analysis
- work on Data Science tasks to expand their understanding of the different approaches and methods.

Social competences

The students

- discuss approaches and problems encountered in smaller and larger groups

Self competences
The students

- reflect on their actions when identifying possible solutions and critically question their own results

Module contents

Data Science is an interdisciplinary science at the intersection of statistics, machine learning, data visualization, and mathematical modeling. This course is designed to provide a practical introduction to the field of Data Science by teaching theoretical principles while also applying them practically. Topics covered range from data collection and preparation (data sources & formats, data cleaning, data bias), mathematical foundations (statistical distributions, correlation analysis, significance) and methods for visualization (tables & plots, histograms, best practices) to the development of models for classifying or predicting values (linear regression, classification, clustering).

Literaturempfehlungen

See description of the assigned course

Links

Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	regular in summer term
Module capacity	unlimited
Teaching/Learning method	V + Ü
Previous knowledge	Basics of databases, Python programming and statistics

Examination	Prüfungszeiten	Type of examination
Final exam of module		
	At the end of the lecture period or by arrangement with the instructor.	Written or oral exam or portfolio or project or practical exercise

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe oder WiSe	28
Exercises		2	SoSe oder WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf462 - Cryptography

Module label	Cryptography
Modulkürzel	inf462
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) • Master's Programme Computing Science (Master) > Theoretische Informatik
Zuständige Personen	• Peter, Andreas (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

Hard requirement: Fundamental knowledge on algorithms, discrete structures, and linear algebra as for instance covered in the following bachelor courses at the UOL:
• inf030 Programmierung, Datenstrukturen und Algorithmen
• mat950 Diskrete Strukturen
• mat955 Linear Algebra für Informatik

Skills to be acquired in this module

Students understand the foundations of modern cryptography. The students can explain the formal security definitions of the most essential cryptographic primitives and can apply proof techniques to show that a given cryptographic construction meets a given security definition. They can identify underlying cryptographic assumptions, analyze them and discuss them in context. In addition, the students are able to build cryptographic primitives that provably meet specific security goals.

Professional competences
The students

• understand definitions of security for different cryptographic primitives,
• discuss the importance of cryptography,
• formalize cryptographic assumptions, and
• carry out security proofs of cryptographic primitives.

Metological competence

The students

• use cryptographic concepts and techniques to increase security, in particular regarding which protection goals can be achieved with which cryptographic techniques,
• apply cryptographic mechanisms in simple scenarios, and
• question the properties and limits of cryptographic concepts and combine different concepts in a meaningful way.

Social competence

The students

• solve problems partially in small groups and thus improve their willingness to cooperate and their communication skills,
• present solutions to cryptographic problems in front of the exercise group,
• discuss their different solutions within the exercise group, and
• improve their English language skills.

Self-competence

The students

• motivate themselves to work on questions and problems in the domain of cryptography,
• justify their own actions with theoretical and methodical knowledge, and
• critically reflect on proposed solutions in relation to social expectations and consequences, taking into account the methods taught.

Module contents

The course provides a rigorous treatment of the basic paradigms and principles of modern cryptography. It puts an emphasis on formal definitions of security, precise assumptions, and rigorous proofs of security in well-defined models.

Concretely, the course deals with the formal and rigorous treatment of the following concepts and primitives:

- Private-Key Encryption
  - Definition of secure encryption and the concept of provable securit
  - Pseudorandom number generators
  - Constructing secure encryption schemes based on pseudorandomness
  - Security under Chosen-Plaintext Attacks (CPA)
  - Pseudorandom functions and the construction of CPA-secure encryption
  - Pseudorandom permutations and block ciphers
  - Security against Chosen-Ciphertext Attacks (CCA)
- Message Authentication Codes (MACs) and hash functions
- Cryptographic assumptions
- Key management
- Public-key cryptography
  - Recap on RSA
  - Attacks on RSA and mitigations
  - The KEM/DEM paradigm
  - Homomorphic Encryption (particularly Paillier)
  - Secret Sharing and Threshold Encryption
- Advanced topics (varying per semester), e.g.:
  - Secure Multiparty Computation
  - Post-Quantum Cryptography
- Zero-Knowledge Proofs

While some of the above topics are typically covered on a very high level in an introductory course on IT security, it should be stressed that this course on cryptography differs substantially by a much more in-depth treatment of the topics with a focus on formal definitions, precise assumptions, and rigorous proofs.

Literaturempfehlungen

- J. Katz and Y. Lindell. Introduction to Modern Cryptography. 3rd edition. Chapman & Hall, ISBN 978-0-815-35436-9, 2020
- D. Boneh and V. Shoup. A Graduate Course in Applied Cryptography. Version 0.6, 2023. Available at: http://toc.cryptobook.us/

Links

Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	Every summer semester
Module capacity	30
Teaching/Learning method	V+Ü
Previous knowledge	Hard requirement: Fundamental knowledge on algorithms, discrete structures, and linear algebra as for instance covered in the following bachelor courses at the UOL: • inf030 Programmierung, Datenstrukturen und Algorithmen • mat950 Diskrete Strukturen • mat955 Linear Algebra für Informatik

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	0
Exercises		2	SoSe	0

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Präsenzzeit Modul insgesamt				0 h

inf518 - Foundations of Energy Informatics

Module label	Foundations of Energy Informatics
Modulkürzel	inf518
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
Zuständige Personen	- Lehrenden, Die im Modul (Prüfungsberechtigt) - Rauh, Andreas (module responsibility) - Vogel-Sonnenschein, Ute (module responsibility)
Prerequisites	

Diesem Modul können Sie gut folgen, wenn Sie Vorkenntnisse mitbringen in

- Grundkenntnisse in Lineare Algebra,
- Analysis,
- Grundlegende Programmierkenntnisse

Skills to be acquired in this module

The students learn to recognize the limits of their own specialist discipline in the application and to identify and classify research questions. They have a basic understanding of the structure of such systems and their physical/chemical properties. and can model simple system components.

Professional competences

The students

- know the basics of modern energy systems and energy markets
- can critically classify issues in the context of energy systems and energy research
- are familiar with the structure of selected energy-related components in energy systems
- know the regulatory challenges and components in energy systems and their electrotechnical properties
- know approaches to the experimental identification of energy technology components.

Methological competences
The students

- can apply computer science methods for energy systems and energy research
- can model and simulate simple dynamic systems in a control-oriented form in Matlab/Simulink
- independently acquire knowledge on given questions

Social competences
The students

- discuss appreciatively in an interdisciplinary context
- work cooperatively in teams to solve given tasks

Self competences
The students

- deepen their competence in presenting the results they have worked out themselves

Module contents

The first part of the module gives an introduces the different topics in energy informatics. The role of computer science in this area is explained on the basis of a subject area and the connection between energy technology and energy management issues and basic IT skills is shown.

Topics are

- Foundations of electrical engineering and power management
- Energy markets
- Network planning and management
- Demand Side Management
- Virtual Power Plants

The second part addresses the control-oriented modelling on the example of energy systems and components taking into account their physical and electro-technical features.
We will derive models of system components like battery storage, wind turbines, photovoltaics and fuel cells.

The participants will design first control-oriented Models with MatLab/Simulink and validate them e.g. by using measurements of open circuit voltages of batteries. (Basics of Matlab Simulink will be explained in the tutorials. The batteries' internal resistances and charge/discharge dynamics are identified by controllable electronic loads in conjunction with programmable rapid control prototyping hardware

Literaturempfehlungen	
Links	
Languages of instruction	German, English
Duration (semesters)	1 Semester
Module frequency	every summer term
Module capacity	20
Teaching/Learning method	V+Ü
Previous knowledge	Linear algebra, calculus, basic programming skills

Examination	Prüfungszeiten	Type of examination
Final exam of module		
	During the semester	Portfolio

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf528 - Introduction to Medical Informatics

Module label	Introduction to Medical Informatics
Modulkürzel	inf528
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik • Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) • Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
Zuständige Personen	• Wulff, Antje (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	
Skills to be acquired in this module	

Introduction to medical informatics

Professional competences

The students

- know the application areas of medical informatics
- know the challenges of informatics in the field of health care
- know IT solutions and infrastructures in the field of health care
- know standards for data exchange and data-driven communication in health care

Methological competences
The students

- recognize and be able to apply the basic methods in the field of medical informatics, specifically:
- learn how to analyze and model health care processes, information systems, and data
- understand medical information models and communication standards

Social competences
The students

- recognize the importance of interdisciplinary communication and collaboration in digitalisation in medicine
- develop, present and discuss the solutions from the exercises with others

Self competences
The students

- are aware of their heterogeneous tasks, responsibility and influence as a computer scientist in the health care sector
- reflect on problems and solutions, incorporating the methods they have learned

Module contents

The assigned lectures will provide an overview of the fields of medical informatics and the unique challenges of applying informatics methods and technologies to medicine and health care.

Literaturempfehlungen

Will be announced in the course

Links

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	every winter term
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	none

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

Wahlpflichtmodule (Technische Informatik)

inf201 - Computer Engineering II

Module label	Computer Engineering II
Modulkürzel	inf201
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Computing Science (Bachelor) > Aufbaumodule - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	- Rauh, Andreas (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Knowledge of the module "Computer Engineering I"
Skills to be acquired in this module	The module qualifies students to analyze computer architectures, understand computer components, design and optimize computers and components, and to discuss domain-specific hardware design. **Professional Competences** The students: - describe computer components - design and optimise computer components - describe and analyse electric circuits **Methological Competences** The students: - analyse computer architectures - get familiar with fundamentals of the analysis and systhesis of flipflops and automata - get familiar with foundations of the analysis of electical circuits **Social Competences** The students: - discuss computer hardware and manufacturing processes competently - are able to transfer their knowledge of hardware design to other domains different from computer science **Self Competences** The students: - critically reflect the results of exercises and acknowledge limitations of various approaches for the design of computer systems
Module contents	This module is the second part of the introduction to computer engineering. It explains sequential circuits (e.g. flipflips and automata), arithmetic and logical computer components, registers and memory, basics of computer communication as well as electrotechnical foundations.
Literaturempfehlungen	- Lecture Notes - Oberschelp, W., Vossen, G.: Rechneraufbau und Rechnerstrukturen; Oldenbourg Verlag - Gajski, D.: Principles of Digital Design; Prentice Hall 1997 - Patterson, D.A., Hennesy, J.L.: Computer Organisation and Design: The Hardware/Software Interface; 2. Edition; Morgan Kaufman Publishers, 1997 - Tannenbaum, A.S.: Structured Computer Organization ; 4. Edition; Prentice Hall, 1999

Links				
Language of instruction		German		
Duration (semesters)		1 Semester		
Module frequency		annual		
Module capacity		unlimited		
Teaching/Learning method		V+Ü		
Previous knowledge		Knowledge of the module "Computer Engineering I"		
Examination		Prüfungszeiten	Type of examination	
Final exam of module		At the end of the lecture period	Written or oral Exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	SoSe	42
Exercises		1	SoSe	14
Präsenzzeit Modul insgesamt				56 h

inf202 - Computer Engineering Practical

Module label	Computer Engineering Practical
Modulkürzel	inf202
Credit points	6.0 KP
Workload	180 h

Verwendbarkeit des Moduls

- Bachelor's Programme Biology (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Business Administration and Law (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Business Informatics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Chemistry (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Comparative and European Law (Bachelor) > Fachnahe Angebote Informatik more...
- Bachelor's Programme Computing Science (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Education (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Engineering Physics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Environmental Science (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Mathematics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Physics (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Social Studies (Bachelor) > Fachnahe Angebote Informatik
- Bachelor's Programme Sustainability Economics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Biology (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Praktische Vertiefung (60 KP)
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme General Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme History (Bachelor) > Fachnahe Angebote Informatik
- Dual-subject bachelor's programme Low German (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Fachnahe Angebote Informatik

- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Music (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Physics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > Fachnahe Angebote Informatik
- Dual-Subject Bachelor's Programme Technology (Bachelor) > Fachnahe Angebote Informatik
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > Fachnahe Angebote Informatik
- Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik)
- Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
- Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Praktische Vertiefung der Informatik

Zuständige Personen	• Fränzle, Martin Georg (module responsibility) • Janßen, Detlef (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Recommendation: inf200 "Fundamentals of Computer Engineering

Skills to be acquired in this module

This course enables students to analyze information technology systems, understand individual components of computers, design and optimize them, and discuss domain-specific hardware design in a qualified manner.

Professional competences

The students

- describe individual components of computers
- design and optimize individual components of computers
- design and optimize automata specify and imply autonomous systems

Methodological competence

The students

- synthesize computer architectures
- can transfer methods of hardware design to different systems

Social competence

The students

- discuss hardware in a qualified manner

Self-competence

The students

- are able to clearly distinguish their level of knowledge from professionals of related disciplines

Module contents

This module is the practical part of the course Introduction to Computer Engineering.

Literaturempfehlungen

- Script for the course
- Patterson, D.A., Hennesy, J.L.: Computer Organisation and Design: The Hardware/Software Interface

Links

Language of instruction	German

Duration (semesters)	1 Semester	
Module frequency	every summer term	
Module capacity	unlimited	
Teaching/Learning method	1 P	
Previous knowledge	Recommendation: inf200 Fundamentals of Computer Engineering	
Examination	Prüfungszeiten	Type of examination
Final exam of module	At the end of the lecture term	Portfolio
Lehrveranstaltungsform	Practical training	
SWS	4	
Frequency	SoSe	
Workload Präsenzzeit	56 h	

inf203 - Embedded Systems I

Module label	Embedded Systems I
Modulkürzel	inf203
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) - Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction - Master's Programme Engineering of Socio-Technical Systems (Master) > Human-Computer Interaction - Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering
Zuständige Personen	- Fränzle, Martin Georg (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	- Basics of technical computer science - Computer Engineering
Skills to be acquired in this module	This module provides an introduction to the design of digital embedded systems. **Professional competence** The students: - name functional and non-functional requirements to specify embedded systems - discuss design space and associated embedded systems design methods - name control and feedback control systems' core concepts - characterise the fundamental digital signal processing algorithms **Methodological competence** The students: - design and develop embedded feedback control systems with modelling tools - implement an embedded hardware-/software system according to a given specification - analyze various specification languages according to different properties **Social competence** The students: - implement solutions to given problems in teams - present results of computer science problems to groups - organize themselves as a team to solve a larger problem using project management methods **Self-competence** The students: - acknowledge the limits of their ability to cope with pressure during the implementation process of systems - solve excercises self-responsibly
Module contents	Embedded systems support complex feedback problems, control problems and data processing tasks. They have an important value creation potential for telecommunications, production management, transport and electronics. The functionality of embedded systems is realised by the integration of processors, special hardware and software. The embedded systems design is influenced by the heterogeneity of system architectures, the complexity of systems and technical and economic requirements. This module gives an overview of embedded systems and their design. The process of digital signals is

especially important for telecommunications and multimedia. For this purpose, the module introduces digital signal processing algorithms. The principles of feedback control are introduced by exemplary transport applications. Subsequently, the module provides the specifications and language characteristics of the embedded system design. For this purpose, graphical data-flow modelling languages (for instance Simulink) and control-flow specifications (for instance State Charts) are presented. The module closes with the concepts of possible architectures and communication models. Hands-on exercises with the tools Matlab/Simulink/StateFlow support the module contents.

Literaturempfehlungen	**Slides and:**

- Harel, D.: STATECHARTS: A Visual Formalism for Complex Systems. Science of Computer Programming, 8, North-Holland, 1987, page(231-274)
- Harel D.: Naamad, A. The STATEMATE Semantics of Statecharts. ACM Trans. Software Engineering Methods, Oct 1996
- Harel, D.; Politi, M.: Modeling Reactive Systems with Statecharts: The Statemate Approach
- Josef Hoffmann: Matlab und Simulink: Beispielorientierte Einführung in die Simulation dynamischer Systeme, Addison-Wesley, 1998, ISBN 3-8273-1077-6
- Staunstrup, J., Wolf, W. (eds.): Hardware/Software Co-Design: Principles and Practice. Kluwer Academic Publishers, 1997, ISBN 0-7923-8013-4, chapters 1, 2, (3), 4, 6, (7), (8-10)
- U. Reimers. Digitale Fernsehtechnik. 2. Aufl., Springer, 1997, ISBN 3-540-60945-8

Secundary literature:

- Debardelaben, J.A.; Gadient, A.J.: Incorporating Cost Modeling in Embedded-System Design. IEEE Design & Test, vol 13, no. 3, 1997
- De Micheli, G.; Sami, M.: Hardware-Software Co-Design. Kluwer, 1996, ISBN 0-7923-3883-9
- Gajski, D.; Vahid, F.; Narayan, S.; Gong, J.: Specification and Design of Embedded Systems. Prentice Hall, 1994, ISBN 0-13-150731-1
- T. Painter, A. Spanias. Perceptual Coding of Digital Audio. Proceedings of the IEEE, vol 88, no 4, April 2000.
- U. Freyer. DVB Digitales Fernsehen. Verlag Technik, 1997, ISBN 3-341-01192-7
- B. Friedrichs. Kanalcodierung: Grundlagen und Anwendungen in modernen Kommunikationssystemen. Springer, 1995, ISBN 3-540-58232-0
- G.C. Clark. Error-correction coding for digital communications. 3rd printing, Plenum Press, 1988, ISBN 0-306-40615-2
- Artikelserie zum MPEG-2-Standard 3/94 10/94 und das Tutorial "Digitale Bildcodierung" 1/92 1/93, beides in "Fernseh- und Kinotechnik" (BIS: Z elt ZA 1536)

Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Reference text	This module is compulsory for students who are specialising in "Eingebettete Systeme und Mikrorobotik". **Associaltes with the modules:** In the module "Eingebettete Systeme II" additonal relevant topics such as design processes, HW/SW-Partitioning, High-Level-Synthesis and Hardware discription languages are discussed. The modules Eingebettete Systeme I und II offer cross-references to the module "Rechnerarchitektur", "Realzeitbetriebssysteme" and semantic orientated modules of theoretical computer science. It is possible to enhance the knowledge of embedded systems design by attending the modules "System Level Design" and "Low energy System Design".
Teaching/Learning method	V+Ü
Previous knowledge	- Basics of technical computer science - Computer Engineering

Examination	Prüfungszeiten	Type of examination
Final exam of module	At the end of the semester	Written or oral exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	WiSe	42
Exercises		1	WiSe	14
Präsenzzeit Modul insgesamt				56 h

inf204 - Embedded Systems II

Module label	Embedded Systems II
Modulkürzel	inf204
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) • Master's Programme Engineering of Socio-Technical Systems (Master) > Embedded Brain Computer Interaction • Master's Programme Engineering of Socio-Technical Systems (Master) > Systems Engineering
Zuständige Personen	• Fränzle, Martin Georg (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirement
Skills to be acquired in this module	The module provides an introduction to digital embedded systems design. **Professional competence** The students: • name embedded systems architectures • name specific hardware components and -architecture designs, particularly processor designs • characterise the design spaces and associated embedded systems design techniques • decompose subcomponents of feedback control systems and implement their tasks in different design spaces • develop software-/hardware components • describe fault-tolerance architecture principles • describe real-time and safety requirements analysing techniques • characterise hardware synthesis **Methodological competence** The students: • estimate the consequences of design decisions in terms of energy usage, performance and reliability component allocations, and designs • implement an embedded hardware-/software system according to a given specification • model hardware with a hardware description languages - analyze Hardware-/Software systems using event-bases simulation **Social competence** The students: • implement solutions to given problems in teams • present results of computer science problems to groups • organize themselves as a team to solve a larger problem using project management methods **Self-competence** The students: • acknowledge the limits of their ability to cope with pressure during the implementation process of systems • deal self responsibly with exercises
Module contents	Embedded systems support complex feedback problems, control problems and data processing tasks. They have an important value creation potential for telecommunications, production management, transport and electronics. The functionality of embedded systems is realised by the integration of processors, special hardware and software. The embedded systems design is influenced by the heterogeneity of system architectures, the complexity of systems and technical and economic requirements. This module is the continuation of the module "Eingebettete Systeme I" and deals with different architectures of embedded systems and processors. The module provides system partitioning methods and the synthesis of hardware components. Hands-on exercises with development tools, hardware description languages and simulation support the

module contents.

Literaturempfehlungen	**Slides and:** • Staunstrup, J.: Wolf, W. (eds.): Hardware/Software Co-Design: Principles and Practice. Kluwer Academic Publishers, 1997, ISBN 0-7923-8013-4, chapters 1, 2, (3), 4, 6, (7), (8-10) • Yen, Ti-Yen; Wolf, W.: Hardware-Software Co-Synthesis of Distributed Embedded Systems. Kluwer, 1996, ISBN 0-7923-9797-5 **Secondary literature:** • Peter J. Ashenden: The Designer's Guide to VHDL. Morgan Kaufmann Publishers, 2002, ISBN 1-55860-674-2 • Lehmann, G.; Wunder, B.; Selz, M.: Schaltungsdesign mit VHDL. Franzis Verlag, 1994, ISBN 3-7723-6163-3 • J. Reichardt, B. Schwarz: VHDL-Synthese, Entwurf digitaler Schaltungen und Systeme. Oldenbourg Wissenschaftsverlag, 2000, ISBN 3-486-25128-7 • Mermet, J. (ed.): Fundamentals and Standards in Hardware Description Languages. Kluwer, 1993, ISBN 0-7923-2513-3 • De Micheli, G.; Sami, M.: Hardware-Software Co-Design. Kluwer, 1996, ISBN 0-7923-3883-9 • Gajski, D.; Vahid, F.; Narayan, S.; Gong, J.: Specification and Design of Embedded Systems. Prentice Hall, 1994, ISBN 0-13-150731-1

Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Reference text	This module is supposed to be a compulsory module for students who are specialising in "Eingebettete Systeme und Mikrorobotik".
Teaching/Learning method	V+Ü
Previous knowledge	none

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	SoSe	42
Exercises		1	SoSe	14
Präsenzzeit Modul insgesamt				56 h

inf205 - Formal Methods in Embedded System Design

Module label	Formal Methods in Embedded System Design
Modulkürzel	inf205
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik)
Zuständige Personen	- Fränzle, Martin Georg (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Sound basic knowledge in mathematical logic, discrete mathematics, automata and computability theory as taught in the modules "Discrete Structures" and "Theoretical Computer Science I + II". In addition, programming skills as acquired in the "Programming Course". Justification: The methods presented in the lecture are based on an operationalization of semantics by reduction to logical encodings and mechanized testing of logical statements. An understanding of these contents as well as their tool-technical implementation requires the basics from the aforementioned courses.
Skills to be acquired in this module	The module provides an overview over semantic models for reactive systems, real-time systems ,and hybrid systems, as well as examples of corresponding specification logics. It explains state-exploratory verification procedures in both explicit and symbolic variants. The knowledge acquired can be employed in all domains requiring the development of reliable software and hardware systems is concerned **Professional competences** The students: - make a sound judgement on the scope of the certificates that can be obtained with formal methods - assess the suitability of available verification tools for a particular problem and system class - use automatic analysis tools on real systems, interpret the results obtained and subsequently improve the system under investigation in an informed and targeted manner - prepare system models for automatic analysis procedures and encode them symbolically (or otherwise) - design and implement their own verification algorithms **Methological competences** The students: - master the mathematical modelling of complex and heterogeneous dynamical systems - know relevant mathematical models of dynamic systems and can instantiate them to new problem classes **Social competences** The students: - together in a team develop and implement basic algorithms of automatic verification - discuss the advantages and disadvantages of algorithmic alternatives and different formalisations **Self competences** The Students: - can assess their technical and methodological understanding - reflect on their problem-solving competence with reference to the procedures and methods presented
Module contents	
	Embedded computer systems maintain constant interaction with their

environment. This induces interaction sequences that are difficult to predict, which complicates the construction and validation of such systems. Akin to the use of structural models for rigorous validation of building layouts in the construction industry, formal models in computer science have consequently been developed for analysis of various aspects of computing systems in general and embedded systems in particular. They cover execution time, energy demand, or possible system dynamics of embedded systems. They represent the respective aspect of the system in a closed form and thus allow for the - often fully automatic - derivation of reliable certificates that apply to any interaction scenario with the environment. This is in contrast to methods of testing or profiling, which only test selected scenarios and thus can only provide limited coverage.

In this module, various such models are explained and methods for their fully automatic analysis -i.e., derivation certificates- or synthesis -i.e., automatic generation of correct system designs- from such models are explained and demonstrated in their application.

The exercises provide opportunity for deepening understanding through hands-on experience with domain-specific modelling and verification

tools, as well as by creating a (small) fully automated verification tool yourself in a guided process.

In the lectures, the semantic, logical, and algorithmic basics of automatic analysis of embedded software systems are taught. The primary form of instruction is the media-supported lecture as well as the didactic question-answer game,.

In the exercise classes, the knowledge acquired in the lecture is deepened and put into practice. For this purpose, in the first half of the semester, exercises are set fortnightly, the completion of which in small groups encourages independent testing of the individual understanding of the topic and peer teaching. In the second half of the semester, a larger tool development task is set, also to be pursued on in small groups of 3 students each. The work on these projects spans the entire second half of the semester and offers the possibility of project-oriented learning. In this phase, the exercise classes serve as consultation time with the lecturers; in particular, solution approaches and problems can be presented and discussed.

Literaturempfehlungen

- Michael Huth, Mark Ryan: Logic in Computer Science: Modelling and Reasoning About Systems. Cambridge University Press, 2004.
- Christel Baier, Joost-Pieter Katoen: Principles of Model Checking. MIT Press, 2008.
- Edmund M. Clarke, Orna Grumberg, Doron A. Peled: Model Checking. MIT Press, 2000.

Links

Languages of instruction	German, English
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	Sound basic knowledge in mathematical logic, discrete mathematics, automata and computability theory as taught in the modules "Discrete Structures" and "Theoretical Computer Science I + II". In addition, programming skills as acquired in the "Programming Course". Justification: The methods presented in the lecture are based on an operationalization of semantics by reduction to logical encodings and mechanized testing of logical statements. An understanding of these contents as well as their tool-technical implementation requires the basics from the aforementioned courses.

Examination	Prüfungszeiten	Type of examination
Final exam of module		Semester project
	• 1st deadline: Submission of the semester project incl. one week after the end of the lecture period of the lecture period; followed by a colloquium and a final discussion • 2nd deadline: Repeat of the submission of the semester project incl. written elaboration	

Examination	Prüfungszeiten	Type of examination
	two weeks before the beginning of the following semester followed by colloquium and final discussion	

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	WiSe	42
Exercises		1	WiSe	14
Präsenzzeit Modul insgesamt				56 h

inf207 - Electrical Engineering

Module label	Electrical Engineering
Modulkürzel	inf207
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) • Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule • Master's Programme Computing Science (Master) > Interdisziplinäre Module
Zuständige Personen	• Hein, Andreas (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Module Analysis II or Numerics
Skills to be acquired in this module	**Professional competence:** The students: • analyse linear electrical networks (direct current and alternating current) • name basic concepts to calculate and to use electrical and magnetic fields • list the characteristics of simple electrical elements (two terminal networks) • calculate the parameters of simple electrical networks/wirings • apply computer based analysing tools • design and implement simple networks/wirings **Methodological competence:** The students: • transfer calculation methods onto complex dynamic systems • implement electrical system models **Social competence:** The students: • present solutions for specific questions **Self-competence:** The students: • reflect their solutions by using methods learned in this course
Module contents	• Basic concepts (electric dimensions and units) • Network elements • Calculation of linear direct current networks (Ohms law, Kirchhoff's circuit law, superposition principle) • Characteristics, calculations and representations of electric and magnetic fields • Construction elements (capacitor and coil) • Extensions of periodical dimensions dependent on time, pointer representation, calculations with complex root-mean-square value pointers
Literaturempfehlungen	**essential:** • slides • Albach: Grundlagen der Elektrotechnik 1 und 2. Pearson Studium, 2004. **recommended:** • Hagmann, G.: Grundlagen der Elektrotechnik. AULA-Verlag, 2002. • Hagmann, G.: Aufgabensammlung zu den Grundlagen der

Elektrotechnik. AULA-Verlag, 2002.

Links				
Language of instruction		German		
Duration (semesters)		1 Semester		
Module frequency		annual		
Module capacity		unlimited		
Teaching/Learning method		V+Ü		
Previous knowledge		Module Analysis II or Numerics		
Examination		Prüfungszeiten	Type of examination	
Final exam of module		At the End of the Semester	Hands-on exercises / written exam or oral exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	SoSe	42
Exercises		1	SoSe	14
Präsenzzeit Modul insgesamt				56 h

inf208 - Microrobotics and Microsystems Technology

Module label	Microrobotics and Microsystems Technology
Modulkürzel	inf208
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) - Master's Programme Computing Science (Master) > Interdisziplinäre Module
Zuständige Personen	- Fatikow, Sergej (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirements
Skills to be acquired in this module	Within the last few years, microrobotics and microsystem technology (MST) have become a focus of interest to industry and evolved into an important field with great application potential. It plays a decisive role for industry to be competitive in many areas such as medicine, production engineering, biotechnology, environmental technology, automotive products, etc. Despite of the growing interest in this new technology, there is hardly any book or lecture course that treats microrobotics and MST in a coherent and comprehensive way. This course is an attempt of the Microrobotics and Control Engineering Division (AMiR) to give students a systematic introduction to microrobotics and MST. It discusses all important aspects of this rapidly expanding technology, its diversity of products and fields of application. The course contains an overview of numerous ideas of new devices and the problems of manufacturing them. **Professional competence:** The students: - name the ideas, challenges and activities of microrobotics and microsystem technology - describe the microrobotics and MST applications - characterise MST methods - name microsensor functionality - characterise microsensor examples - discuss MST terms of information technology - classify microrobotics **Methodological competence** The students: - discover interdisciplinary connections and links between scientific and technical fields of research and development - learn technical abstraction of complex contexts **Social competence** The students: - solving problems partially as group - present their solutions and approaches to the group **Self-competence** The students: - reflect their knowledge of technical computer science - learn to expand on their professional competence independently
Module contents	**Ideas and problems of microrobotics and MST:** - applications; - techniques of MST; - silicon-based micromechanics; - LIGA technology; **Microactuators:** - principles and examples (electrostatic, piezoelectric, magnetostrictive, electromagnetic, SMA-based, thermomechanical, electrorheological

and other actuators);

Microsensors:

- principles and examples (force and pressure, position and speed, acceleration, biological and chemical, temperature and other sensors);
- MST and information processing;
- microsystem design and simulation;
- classification of microrobots;
- coarse positioning of a microrobot;
- fine positioning of a microrobot;

Handling of microparts:

- problems and solutions;
- micro grasp techniques;
- microassembly;

Process automation by microrobots:

- desktop robot cell in SEM

Literaturempfehlungen	
	Essential:
	- Vorlesungsskript in Buchform
	Recommended:
	- Fatikow, S.: Mikroroboter und Mikromontage, Teubner, Stuttgart Leipzig, 2000
	- Fatikow, S./Rembold, U.: Microsystem Technology and Microrobotics, Springer, Berlin Heidelberg New York, 1997
	- Menz, W. und Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH, Weinheim, 1997
	Secondary Literature:
	- Brück, A. und Schmidt, A.: Angewandte Mikrotechnik, Hanser, München Wien, 2001
	- Ehrfeld, W. (Hrsg.): Handbuch Mikrotechnik, Hanser, München Wien, 2000
	- Elbel, Th.: Mikrosensorik, Vieweg, Wiesbaden, 1996
	- Fukuda, T. and Menz, W. (Eds.): Micro Mechanical Systems, Elsevier, Amsterdam, 1998
	- Gardner, J.W.: Microsensors, Wiley, Chichester, 1994
	- Gerlach, G. und Dötzel, W.: Grundlagen der Mikrosystemtechnik, Hanser, München Wien, 1997
	- Krause, W.: Fertigung in der Feinwerk- und Mikrotechnik, Hanser, 1995
	- Mescheder, U.: Mikrosystemtechnik, Teubner, Stuttgart Leipzig, 2000
	- Tränkler, H.-R. und Obermeier, E. (Hrsg.): Sensortechnik, Springer, Berlin Heidelberg, 1998
	- Völklein, F. und Zetterer, Th.: Einführung in die Mikrosystemtechnik, Vieweg, Wiesbaden, 2000

Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Reference text	**Associated with the modules:**
	- Embedded Systems and Microrobotics

Teaching/Learning method	V+Ü
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module	At the end of the semester	Oral exam in German

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	WiSe	42
Exercises		1	WiSe	14
Präsenzzeit Modul insgesamt				56 h

inf209 - Control Theory

Module label	Control Theory
Modulkürzel	inf209
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) • Master's Programme Computing Science (Master) > Interdisziplinäre Module
Zuständige Personen	• Fatikow, Sergej (module responsibility) • Hein, Andreas (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	• Differential Equations • Analysis II • Fundamentals of electrical engineering
Skills to be acquired in this module	Instruction on theoretical and mathematical basics of control engineering **Professional competence** The students: • describe the core principles of steering and control of technical systems • discuss the modelling core concepts of systems and their controllers • name methods to determine the quality of controlled systems • model technical systems with differential equations and their transfer functions • develop control structures, evaluate their stabilty and determine their optimal control parameters **Methodological competence** The students: • are aware of the technical challenges and solve them by including the implementations of other disciplines and methods **Social competence** The students: • present solutions for specific questions **Self-competence** The students: • get used to the specific challenges of the development of controlled systems
Module contents	**Basics** **analog transfer elements:** • linear time invariant (LTI-) systems; • simulation and modeling; • step response; • frequency response; • frequency response locus; • differential equations and transfer function; control loop stability; • types of controlled systems; • types of linear controllers; **linear control loops:** • reference and disturbance reaction of the controlled system; • rules for control loop optimization; • methods of analysis and synthesis, implementation; • computerbased control MATLAB/Simulink

Literaturempfehlungen

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

Links

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	- Differential Equations - Analysis II - Fundamentals of electrical engineering

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	WiSe	42
Exercises		1	WiSe	14
Präsenzzeit Modul insgesamt				56 h

inf210 - Signal and Image Processing

Module label	Signal and Image Processing
Modulkürzel	inf210
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Technische Informatik (30 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Technische Informatik) - Master's Programme Computing Science (Master) > Interdisziplinäre Module
Zuständige Personen	- Hein, Andreas (module responsibility) - Fränzle, Martin Georg (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Module math040 Analysis II b: Differential calculus of several variables
Skills to be acquired in this module	**Professional competence** The students: - name the concepts of signal and image processing in technical systems - name the methods/algorithms of preprocessing, filtering, classification, interpretation and visualisation of signals and pictures - Select algorithms appropriately - evaluate the effectiveness of algorithms - design algorithms and processing chains and evaluate their quality **Methodological competence** The students: - get used to specific subjects of signal and image processing **Social competence** The students: - present solutions for specific questions in signal and image processing **Self-competence** The students: - reflect their solutions by using methods learned in this course
Module contents	**Basic Concepts:** - Signal Processing - Signal Spaces and Signal Processing Systems - Discrete and Constant Signals - Labelling of Signal Transmitters with Test Signals - Representations Areas and Transformations - Time-Discrete Systems and Scanning - Estimation and Filtering - Construction with MATLAB - Image Processing **Introduction / Range of Applications:** - Functional Transformation - Image Enhancement/Filtering - Segmentation 3D Reconstruction an Visualization
Literaturempfehlungen	**Essential:** - Foliensammlung zur Vorlesung **Recommended:** - Meyer, M.; Signalverarbeitung: Analoge und digitale Signale, Systeme und Filter

- Grüningen, D. C. v.; Digitale Signalverarbeitung: mit einer Einführung in die kontinuierlichen Signale und Systeme
- Tönnies, K.; Grundlagen der Bildverarbeitung; Pearson Studium 2005
- Lehmann, Th.; Oberschelp, W.; Pelinak, E.; Pepges, R.; Bildverarbeitung in der Medizin; Springer Verlag 1997
- Handels. H.; Medizinische Bildverarbeitung; Teubner Verlag, Stuttgart
- Leipzig 2000 weiterführende Literatur wird in der Vorlesung bekannt gegeben

Links				
Language of instruction		German		
Duration (semesters)		1 Semester		
Module frequency		annual		
Module capacity		unlimited		
Teaching/Learning method		V+Ü		
Previous knowledge		Module math040 Analysis II b: Differential calculus of several variables		
Examination		Prüfungszeiten	Type of examination	
Final exam of module		At the end of the semester	Hands-on exercises and written or oral exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

Wahlpflichtmodule (Theoretische Informatik)

inf040 - Introduction to Data Science

Module label	Introduction to Data Science
Modulkürzel	inf040
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich - Master Applied Economics and Data Science (Master) > Data Science - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Praktische Informatik) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich - Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen	- Wingerath, Wolfram (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	
	Basics of databases, Python programming and statistics
Skills to be acquired in this module	

The module teaches fundamentals from the field of Data Science, covering purposes, challenges, and common best practices.

Professional competences

The students

- have knowledge of basic concepts, problems and solution approaches from the field of Data Science.
- are able to justify the choice of specific data analysis methods for a given problem
- include possible imponderables in the analysis when evaluating analysis results

Methological competences
The students

- are able to translate questions from a specific domain into a feasible analysis
- work on Data Science tasks to expand their understanding of the different approaches and methods.

Social competences

The students

- discuss approaches and problems encountered in smaller and larger groups

Self competences
The students

- reflect on their actions when identifying possible solutions and critically question their own results

Module contents

Data Science is an interdisciplinary science at the intersection of statistics, machine learning, data visualization, and mathematical modeling. This course is designed to provide a practical introduction to the field of Data Science by teaching theoretical principles while also applying them practically. Topics covered range from data collection and preparation (data sources & formats, data cleaning, data bias), mathematical foundations (statistical distributions, correlation analysis, significance) and methods for visualization (tables & plots, histograms, best practices) to the development of models for classifying or predicting values (linear regression, classification, clustering).

Literaturempfehlungen

See description of the assigned course

Links

Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	regular in summer term
Module capacity	unlimited
Teaching/Learning method	V + Ü
Previous knowledge	Basics of databases, Python programming and statistics

Examination	Prüfungszeiten	Type of examination
Final exam of module		
	At the end of the lecture period or by arrangement with the instructor.	Written or oral exam or portfolio or project or practical exercise

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe oder WiSe	28
Exercises		2	SoSe oder WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf400 - Theoretical Computer Science: Logic

Module label	Theoretical Computer Science: Logic
Modulkürzel	inf400
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Basismodule • Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP) • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik) • Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	• Wehrheim, Heike (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirements
Skills to be acquired in this module	Introduction to propositional logic, predicate logic, logic programming, and temporal logic **Professional competence** The students: • know syntax, semantics and applications of propositional logic, predicate logic, logic programming, and temporal logic • specify problems by using logical formulas • solve questions concerning propositional formulas with truth tables • draw conclusions in the field of propositional logic and predicate logic by means of natural deduction • answer queries to logic programs by using SLD resolution • perform model checking of Kripke structures with regard to CTL formulas algorithmically **Methodological competence** The students: • recognize logic as a versatile tool in computer science **Social competence** The students: • work together in small groups to solve problems • present solutions to problems to groups of other students **Self-competence** The students: • learn persistence in pursuing difficult tasks • learn precision in writing down solutions
Module contents	The course introduces propositional, predicate and temporal logic. In computer science it is essential to have a good understanding of logic because the language of logical formulas is widely used in the field of computer science. For example, Boolean expressions appear in every programming language and in circuit design; Horn clauses are used in knowledge representation; predicate logic and temporal logic are used for specifying software and hardware. More recent applications such as interactive and automatic proving as well as the logic programming language PROLOG emphasize the tool character of logic in computer science. The course introduces syntax, semantics, procedures, and calculi to prove the validity of formulas of propositional, predicate, and temporal logic. This is illustrated by many examples. Central is the concept of logical consequence. **Topics:** • propositional logic: syntax and semantics, truth tables, natural deduction • predicate logic: syntax and semantics, natural deduction • logic programming: declarative and procedural semantics, unification algorithm (Robinson), SLD resolution, PROLOG • temporal logic CTL: syntax and semantics of Kripke structures, CTL model checking algorithm

| **Literaturempfehlungen** | | **Essential:** Script "Logik" (in German), in its current edition
Recommended: D. van Dalen: "Logic and Structure", Fourth Edition. Springer-Verlag, 2004.
Good secondary reading: U. Schöning: "Logic for Computer Scientists", Birkhäuser, 1994. | |

Links			
Language of instruction		German	
Duration (semesters)		1 Semester	
Module frequency		annual	
Module capacity		unlimited	
Teaching/Learning method		V+Ü	
Previous knowledge		none	

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	SoSe	42
Exercises		1	SoSe	14
Präsenzzeit Modul insgesamt				56 h

inf407 - Program Verification

Module label	Program Verification
Modulkürzel	inf407
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Wahlpflicht Theoretische Informatik (30 KP) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik)
Zuständige Personen	- Wehrheim, Heike (module responsibility) - Olderog, Ernst-Rüdiger (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Theoretical computer science I and II
Skills to be acquired in this module	Introduction to methods for proving the correctness of sequential, parallel, and distributed programs. **Professional competence** The students: - describe operational semantics of sequential, parallel, and distributed programs - Know the concepts of partial and total correctness of programs - establish soundness and completeness of proof systems - construct input-output specifications of programs - conduct correctness proofs for programs of different classes with the help of proof rules - check interference and deadlock freedom of parallel programs - transform parallel and distributed programs into nondeterministic programs **Methodological competence** The students: - recognize correctness as an important aspect of programs and informatics systems **Social competence** The students: - work together in small groups to solve problems - present their solutions to groups of other students **Self-competence** The students: - learn persistence in pursuing difficult tasks - learn precision in specifying problems
Module contents	Program verification is a systematic approach to show the absence of errors in programs. For this purpose desirable behavioural properties of a given program are proven. For instance, a sorting program should only deliver sorted arrays. Partial correctness, termination, and the absence of runtime errors are essential for sequential programs. Additional behavioural properties are of interest for parallel programs: absence of interference, absence of deadlocks, and fair behaviour. The module focuses on the verification of parallel programs. For this purpose classic methods of Hoare's logic are combined with more recent techniques of program transformation. Sequential programs are covered in preparation for this.
Literaturempfehlungen	**essential:** "K.R. Apt, E.-R. Olderog, Programmverifikation, Springer-Verlag, 1994" **Or the extended English version:** "K.R. Apt, F.S. de Boer, E.-R. Olderog, Verfication of Sequential and Concurrent Programs, Third Edition, Springer-Verlag, 2008"
Links	

Language of instruction			German	
Duration (semesters)			1 Semester	
Module frequency			irregular	
Module capacity			unlimited	
Teaching/Learning method			1VL + 1Ü	
Previous knowledge			Theoretical computer science I and II	

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		3	siehe Angebotsrhythmus Modul	42
Exercises		1	siehe Angebotsrhythmus Modul	14
Präsenzzeit Modul insgesamt				56 h

inf410 - Formal Methods

Module label	Formal Methods
Modulkürzel	inf410
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	• Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik • Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik)
Zuständige Personen	• Wehrheim, Heike (module responsibility) • Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	Useful previous knowledge: Course Logic
Skills to be acquired in this module	Formal methods are mathematically well-defined languages for the modelling of systems. The students get to know different formal methods and learn about their usage for the modelling and analysis of systems. For a given task, they choose adequate formalisms and their corresponding analysis technique, apply these and interpret the outcome of the analysis. **Professional competence** The students: • apply mathematical formalisms to the modelling of systems • choose an adequate modelling formalism for some given task • formally specify systems • choose suitable analysis techniques • interpret results of analysis runs **Methodogical competence** The students: • carry out formal correctness proofs • employ analysis tools • define the semantics of formal specification languages **Social competence** The students: • work in groups on tasks and explain solutions to each other • discuss the advantages and disadvantages of modelling formalisms. **Self-competence** The students: • organise themselves for the work in the module
Module contents	• Short recap of predicate logic, use of predicate logic in program verification • Petri nets • Process algebra CCS • Timed automata • Z
Literaturempfehlungen	
Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	every summer term
Module capacity	unlimited

Teaching/Learning method		1VL + 1Ü		
Previous knowledge		Useful previous knowledge: Course Logic		
Examination		Prüfungszeiten	Type of examination	
Final exam of module		Weekly assignments, oral examination at the end	Written or oral Exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	siehe Angebotsrhythmus Modul	28
Exercises		2	siehe Angebotsrhythmus Modul	28
Präsenzzeit Modul insgesamt				56 h

inf420 - Introduction to IT-Security

Module label	Introduction to IT-Security
Modulkürzel	inf420
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich - Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen	- Peter, Andreas (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirements
Skills to be acquired in this module	

Students understand the basic concepts, methods and protocols for protecting data and systems from manipulation and misuse on a basic, practice-oriented, scientific level (see "contents of the module"). The students can explain the causes of security problems in today's systems, can reproduce the connections between protection mechanisms and the problems they address, and can apply them to case studies. They can identify vulnerabilities, analyze them and understand the attack mechanisms described. In addition, the students are able to discuss possible solutions and are able to protect systems accordingly.

Professional competence
The students

- understand the semantics of security and explain the properties of secure IT systems (see "contents of the module"),
- discuss the importance of IT security, and
- carry out simple security analyses of systems.

Methological competence

The students

- use concepts and techniques to increase security, in particular regarding which protection goals can be achieved with which techniques (see "contents of the module"),
- apply mechanisms of IT security in simple scenarios, and
- question the properties and limits of security concepts and combine different concepts in a meaningful way.

Social competence

The students

- solve problems partially in small groups and thus improve their willingness to cooperate and their communication skills,
- present solutions to IT security problems in front of the exercise group,
- discuss their different solutions within the exercise group, and
- improve their English language skills.

Self-competence
The students

- motivate themselves to work on questions and problems in the domain of IT security,
- justify their own actions with theoretical and methodical knowledge, and
- critically reflect on proposed solutions in relation to social expectations

and consequences, taking into account the methods taught.

Module contents

The course provides a broad introduction to IT security, covering the following topics:

- basic terms, concepts, and principles in IT security,
- major cryptographic building blocks (encryption, signatures, ...),
- access control models and mechanisms,
- authentication and key exchange protocols,
- network security basics,
- anonymous communication (including TOR), and
- basics of privacy protection.

Literaturempfehlungen

- C. Eckert. IT-Sicherheit: Konzepte – Verfahren – Protokolle. 10th edition. De Gruyter Oldenbourg, ISBN 978-3-110-58468-4, 2018
- P. van Oorschot. Computer Security and the Internet. 2nd edition. Springer, ISBN 978-3-030-83410-4, 2021
- R. Anderson. Security Engineering: A Guide to Building Dependable Distributed Systems. 2nd edition. Wiley, ISBN 978-0470068526, 2008

Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	Every winter semester
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	Hard requirement: Fundamental knowledge on algorithms, discrete structures, and linear algebra as for instance covered in the following courses at the UOL: • inf030 Programmierung, Datenstrukturen und Algorithmen • mat950 Diskrete Strukturen • mat955 Linear Algebra für Informatik Useful (but optional) additional knowledge: Basics of computer networks as for instance covered in the UOL course inf010 Rechnernetze

Examination	Prüfungszeiten	Type of examination
Final exam of module		
		Written or oral exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	2
Exercises		2	WiSe	2
Präsenzzeit Modul insgesamt				4 h

Wahlpflichtmodule (Angewandte Informatik)

inf420 - Introduction to IT-Security

Module label	Introduction to IT-Security
Modulkürzel	inf420
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Pflichtmodule - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Theoretische Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich - Master's Programme Computing Science (Master) > Praktische Informatik
Zuständige Personen	- Peter, Andreas (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirements
Skills to be acquired in this module	

Students understand the basic concepts, methods and protocols for protecting data and systems from manipulation and misuse on a basic, practice-oriented, scientific level (see "contents of the module"). The students can explain the causes of security problems in today's systems, can reproduce the connections between protection mechanisms and the problems they address, and can apply them to case studies. They can identify vulnerabilities, analyze them and understand the attack mechanisms described. In addition, the students are able to discuss possible solutions and are able to protect systems accordingly.

Professional competence
The students

- understand the semantics of security and explain the properties of secure IT systems (see "contents of the module"),
- discuss the importance of IT security, and
- carry out simple security analyses of systems.

Methological competence

The students

- use concepts and techniques to increase security, in particular regarding which protection goals can be achieved with which techniques (see "contents of the module"),
- apply mechanisms of IT security in simple scenarios, and
- question the properties and limits of security concepts and combine different concepts in a meaningful way.

Social competence

The students

- solve problems partially in small groups and thus improve their willingness to cooperate and their communication skills,
- present solutions to IT security problems in front of the exercise group,
- discuss their different solutions within the exercise group, and
- improve their English language skills.

Self-competence
The students

- motivate themselves to work on questions and problems in the domain of IT security,
- justify their own actions with theoretical and methodical knowledge, and
- critically reflect on proposed solutions in relation to social expectations and consequences, taking into account the methods taught.

Module contents

The course provides a broad introduction to IT security, covering the following topics:

- basic terms, concepts, and principles in IT security,
- major cryptographic building blocks (encryption, signatures, ...),
- access control models and mechanisms,
- authentication and key exchange protocols,
- network security basics,
- anonymous communication (including TOR), and
- basics of privacy protection.

Literaturempfehlungen

- C. Eckert. IT-Sicherheit: Konzepte – Verfahren – Protokolle. 10th edition. De Gruyter Oldenbourg, ISBN 978-3-110-58468-4, 2018
- P. van Oorschot. Computer Security and the Internet. 2nd edition. Springer, ISBN 978-3-030-83410-4, 2021
- R. Anderson. Security Engineering: A Guide to Building Dependable Distributed Systems. 2nd edition. Wiley, ISBN 978-0470068526, 2008

Links

Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	Every winter semester
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	Hard requirement: Fundamental knowledge on algorithms, discrete structures, and linear algebra as for instance covered in the following courses at the UOL: • inf030 Programmierung, Datenstrukturen und Algorithmen • mat950 Diskrete Strukturen • mat955 Linear Algebra für Informatik Useful (but optional) additional knowledge: Basics of computer networks as for instance covered in the UOL course inf010 Rechnernetze

Examination	Prüfungszeiten	Type of examination
Final exam of module		
		Written or oral exam

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	2
Exercises		2	WiSe	2
Präsenzzeit Modul insgesamt				4 h

inf521 - Medical Informatics

Module label	Medical Informatics
Modulkürzel	inf521
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule
Zuständige Personen	- Wulff, Antje (module responsibility) - Kaspar, Mathias (Module counselling) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	No participant requirement
Skills to be acquired in this module	This module provides an introduction to the medical informatics and medical technology. **Professional competence** The students: - know the medical and healthcare computer science applications - know typical IT solutions and infrastructures - know the legal framework to process care data - know medical classifications and nomenclatures and the DRG-System and are able to apply them **Methodological competence** The students: - know bio-medical research requirements and patient data privacy methods - know communication standards and apply them in small-scale scenarios - know and apply patient safety and risk management methods - know and apply biosignal and image processing methods **Social competence** The students: - realise the importance of communication during the software development process between developer, customer and user of a successful and secure system. Feedback, request, respectful cooperation and the empathy of other disciplines' working processes are of great importance. **Self-competence** The students: - realise their responsibility as a medical informatic and reflect their impact on patients, medical employers and hospitals (corporates)
Module contents	- Medical informatics introduction / medical documentation - Medical documentation / progression of disease - Healthcare information systems - Terminology and classification / Medical controling - Image processing / interoperability and communication standards - Medical data privacy - Medical research - Analyses of information system data - Decision making support and process management - MI/MT patient safetiness (Regulatory Affairs) - Telemedicine / Customer Health informatics - Medical technology introduction, biomedical technology - Biosignal processing, sensor technology - Robotics, prosthetics

Literaturempfehlungen

- Jan van Bemmel , M.A. Musen , Mark A. Musen (Hrsg.): Handbook of Medical Informatics. Springer, Heidelberg 1997
- Christian Johner und Peter Haas (Hrsg.): Praxishandbuch IT im Gesundheitswesen
- Carl Hanser Verlag München 2009
- Dugas, Schmidt: Medizinische Informatik und Bioinformatik. Springer Verlag, Berlin, 2003

Links			
Language of instruction	German		
Duration (semesters)	1 Semester		
Module frequency	annual		
Module capacity	unlimited		
Teaching/Learning method	1VL + 1Ü		
Previous knowledge	none		
Examination	Prüfungszeiten	Type of examination	
Final exam of module	At the end of the lecture period	Written or oral exam	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf530 - Artificial Intelligence

Module label	Artificial Intelligence
Modulkürzel	inf530
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	- Sauer, Jürgen (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	
	Basic knowledge of computer science/business informatics
Skills to be acquired in this module	

The students are familiar with the basic concepts of artificial intelligence (AI). They know the concept of rational agents and their behavior. They know how to implement expert systems.They also know basic search and problem solving techniques as well as techniques of knowledge representation. The students can compare different problem solving techniques and use them within other problem contexts. **Professional competence**
The students:

- describe the concept of rational agents and their behavior in an agent environemt
- name and describe the basic search and problem solving techniques of Artificial Intelligence
- describe and implement expert systems
- describe basic techniques of knowledge representation

Methodological competence
The students:

- acknowledge the basic methods of AI
- transfer AI methods to other application areas
- evaluate AI methods regarding their appropriateness for destinct problem areas
- modify and adapt AI methods for specific application areas

Social competence
The students:

- work in teams
- present results to groups

Self-competence
The students:

- reflect their results with regard to the methods of AI

Module contents

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

Literaturempfehlungen

- Russel, S. J.: Norvig, Peter (2012): Artificial Intelligence: A modern Aproach, 3rd Ed.
- Winston, P.H. (1994): Artificial Intelligence, 3rd Edition

Links			
Language of instruction		German	
Duration (semesters)		1 Semester	
Module frequency		annual	
Module capacity		unlimited	
Teaching/Learning method		V+Ü	
Previous knowledge		Basic knowledge of computer science/business informatics	

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf600 - Business Informatics I

Module label	Business Informatics I
Modulkürzel	inf600
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Basiscurriculum - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik - Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Hauptschule und Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Pflichtbereich
Zuständige Personen	- Sauer, Jürgen (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	

No participant requirements

Skills to be acquired in this module

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

Professional competence
The students:

- describe the key aspects of business informatics
- differentiate business informatics as an interdisciplinary subject from other subjects
- characterise the functionality of essential application systems and management structures, from the strategical to the tactical and operative level.
- consider and evaluate case studies and layout options for the conception, development, implementation, usage and maintenance of operational sociotechnical applications systems

Methodological competence
The students:

- model technical and sociotechnical processes using suitable tools
- analyse business processes and the demands on their modification and their technical assistance
- abstract from complex systems in a suitable way to improve the manageability of models

Social competence
The students:

- present their solutions in front of other groups
- discuss their outcomes

Self-competence
The students:

- develop solutions for case studies in groups
- construct an argument based on aquired knowledge

Module contents

The main topics of business informatics are the presentation and evaluation of configuration options to conceptualise, develop, implement, use and maintain operational sociotechnical application systems. The lecture focusses on information systems of the networked company. Technical, economic, organisational, and psychosocial aspects are considered. The understanding of these relations will be trained by means of case studies taken from Laudon et al. (cf. suggested reading).

The lecture gives an overview of the following business informatics fields:

- Information systems, (object of BI)
- Application systems
- E-Commerce and E-Business
- Ethical, social and political aspects
- Business process integration
- Knowledge management
- Support of decision making
- Reorganisation of companies
- Economic evaluation For a better understanding of each subject, it is recommended to take specific modules later in the course of studies.

Literaturempfehlungen

- Laudon, Laudon, Schoder (2006): Wirtschaftsinformatik. Eine Einführung. Pearson Verlag Krallmann,
- Frank, Gronau (2002), Systemanalyse im Unternehmen Oldenbourg (Gebundene Ausgabe - Juni 2002)

Links

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	every winter term
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	none

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf601 - Business Informatics II

Module label	Business Informatics II
Modulkürzel	inf601
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum - Pflichtbereich - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik - Bachelor's Programme Sustainability Economics (Bachelor) > Wahlpflichtbereich - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik)
Zuständige Personen	- Marx Gómez, Jorge (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)

Prerequisites

No participant requirements

Skills to be acquired in this module

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

Professional competence
The students:

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

Methodological competence

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

Social competence
The students:

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

Self-competences
The Students:

- accept criticism and unterstand it as a procpdition for the further development of one's own actions

Module contents

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

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

Literaturempfehlungen

- Heinrich, Stelzer (2011): Informationsmanagement
- Grundlagen, Aufgaben, Methoden. Oldenbourg Verlag
- Laudon, Laudon, Schoder (2010): Wirtschaftsinformatik
- Eine Einführung. Pearson Verlag
- Krcmar (2015): Informationsmanagement. Springer Verlag

Links

http://www.wi-ol.de

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module		
	Usually two weeks after lecture time	Written exam max. 120 minutes

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h

inf603 - Planning and Simulation in Logistics

Module label	Planning and Simulation in Logistics
Modulkürzel	inf603
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Akzentsetzungsbereich Praktische Informatik und Angewandte Informatik - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik)
Zuständige Personen	- Sauer, Jürgen (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	

No participant requirements

Skills to be acquired in this module

Introduction to the problems/challenges of simulation and planning of applications in production and logistics. The students will learn the simulation with a tool in hands-on exercises.
Learning objectives:
The Students

- have knowledge of basic problems/challenges of simulating and planning in the field of production and logistic
- know approaches and algorithms to solve simulation and planning problems/challenges
- are able to model solutions for simple production problems/challenges with a simulation tool and
- are able to solve given tasks with it
- are able to identify, classify and associate solutions to problems/challenges
- are abel to model and implement a production plan with the simulation tool

Professional competence
The students:

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

Methodological competence
The students:

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

Social competence
The students:

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

Self-competence
The students:

- Reflect their own solutions in conjunction with other solutions

Module contents

This module provides the basic production and logistic planning and simulation approaches/concepts. Supply chain planning problems are introduced and

simple algorithmic solutions are introduced and implemented. The hands-on simulation with a tool is provided by a case study from the production.

Literaturempfehlungen

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

Links

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	none

Examination	Prüfungszeiten	Type of examination
Final exam of module		
	At the end of the lecture period	Portfolio consisting of: Active involvement, presentation and documentation of results, hands-on achievements

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

inf608 - eBusiness

Module label	eBusiness
Modulkürzel	inf608
Credit points	6.0 KP
Workload	180 h
Verwendbarkeit des Moduls	- Bachelor's Programme Business Informatics (Bachelor) > Aufbaucurriculum - Pflichtbereich - Bachelor's Programme Computing Science (Bachelor) > Akzentsetzungsbereich - Wahlbereich Informatik - Bachelor's Programme Economics and Business Administration (Bachelor) > Studienrichtung Wirtschaftsinformatik - Master of Education Programme (Gymnasium) Computing Science (Master of Education) > Wahlpflichtmodule (Angewandte Informatik) - Master of Education Programme (Hauptschule and Realschule) Computing Science (Master of Education) > Mastermodule - Master of Education Programme (Vocational and Business Education) Computing Science (Master of Education) > Akzentsetzungsbereich
Zuständige Personen	- Marx Gómez, Jorge (module responsibility) - Lehrenden, Die im Modul (Prüfungsberechtigt)
Prerequisites	

No participant requirement

Skills to be acquired in this module

The module provides an introduction to the "Electronic Business" (e-business). The graduates know the fundamental and current technologies, advanced concepts, applications and competitive strategies of the "Electronic-Commerce" (e-commerce). The knowledge and abilities acquired in this module are directly applicable in study and business. They are deepening the basics from the module „Wirtschaftsinformatik II". They provide a professional e-business consulting background and the skills to design software products for this area of business in practice.

Professional competence
The students:

- name and discuss the eBusiness key challenges
- discuss the chances of the added value and the changes of commercial models by the internet
- define the concepts of e-business and e-commerce.
- discuss the change of retail trade and the transactions between companiess in e-business
- name current payment systems and communication technologies
- discuss the possibilities of the internet in order to simplify the administration and the coordination of internal and external business processes
- characterise the challenges for the management caused by e-business and e-commerce
- differentiate the concepts and conceptualites of e-business
- assess applications with regard to economic points of view
- practically learn how to handle core technologies of e-business

Methodological competence
The students:

- assess the core technologies of e-business and e-commerce
- apply methods in case studies

Social competence
The students:

- develop case studies on basis of given problems in groups
- present their solutions

Self-competence
The students:

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

Module contents

The module provides the following contents:

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

Literaturempfehlungen

- Meier, Andreas; Management der digitalen Wertschöpfungskette. Springer, 2. Auflage, 2008.
- Wirtz, Bernd W.: Electronic Business. Springer Gabler, 4. Auflage, 2013.
- Kollmann, Tobias: E-Business: Grundlagen Elektronischer Geschäftsprozesse in der Net Economy. Gabler, 4. Auflage, 2010.

Links

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

Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	annual
Module capacity	unlimited
Teaching/Learning method	V+Ü
Previous knowledge	none

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

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe	28
Exercises		2	SoSe	28
Präsenzzeit Modul insgesamt				56 h