

# Module handbook

## International Computer Science (B.Sc.)

undergraduate programme

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Faculty of Computer Science and Mathematics

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<b>Module title</b>		<b>Module code</b>	
Automata, Formal Languages and Computation			
<b>Person responsible for the module</b>		<b>Faculty</b>	
Prof. Dr. Kai Selgrad		Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
1.	1.	mandatory	5

<b>Mandatory requirements</b>
No prerequisites necessary
<b>Recommended previous knowledge</b>
Attendance of the pre- and bridge courses is recommended

<b>Content</b>
see next page

**Assigned submodules**

Nr.	Submodule title	Teaching hours	Credit value
1.	Automata, Formal Languages and Computation	4 SWS	5

Submodule		Submodule abbreviation	
Automata, Formal Languages and Computation		ALC	
Responsible person		Faculty	
Prof. Dr. Kai Selgrad		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Kai Selgrad		only in winter semester	
Teaching method			
Seminar teaching (2 SWS) with exercises (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
1.	4 SWS	english	5

Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam 90 minutes

Content
<p>Computability</p> <ul style="list-style-type: none"> <li>- Sets in computer science</li> <li>- Halting problem</li> <li>- Reductions</li> <li>- Complexity</li> </ul> <p>Formal languages and automata theory</p> <ul style="list-style-type: none"> <li>- Alphabets, words, languages</li> <li>- Languages for problem description (especially: decision problems)</li> <li>- Deterministic and non-deterministic finite automata and their equivalence, minimisation of automata</li> <li>- Regular expressions and languages</li> <li>- Grammars and Chomsky hierarchy</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to, apply (2) and explain (2) the scientific contents dealt with in the lecture. Furthermore, they are aware of the practical implications (2), in particular the possibilities and limits of the application of computer systems (3) and they are equipped with solid formal tools to put practical approaches on a solid foundation (2).</p>

<b>Learning objectives: Personal competence</b>
After successful completion of the submodule, students are able to, communicate professionally (2) to work on problems analytically/formally and independently (2) and being more comfortable with abstract-formal works (1).
<b>Teaching media</b>
Blackboard, slides
<b>Literature</b>
<ul style="list-style-type: none"><li>• Michal Sipser: Introduction to the Theory of Computation, Thomson Course Technology, 2006</li><li>• Uwe Schöningh: Theoretische Informatik – kurzgefasst, Spektrum Akademischer Verlag, 1995</li><li>• John E. Hopcroft, Jeffrey D. Ullmann, Rajeev Motwani: "Introduction to Automata Theory, Languages and Computation" von John E. Hopcroft, Pearson Studium, 2002</li><li>• Gottfried Vossen und Kurt-Ulrich Witt: Grundlagen der Theoretischen Informatik mit Anwendungen, Vieweg, 2002</li><li>• Hoffmann: Theoretische Informatik</li></ul>

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Business Administration		
Person responsible for the module	Faculty	
Prof. Dr. Alixandre Ferreira de Santana	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
1.	1.	mandatory	5

Mandatory requirements
no prerequisites necessary
Recommended previous knowledge
no prerequisites recommended

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Business Administration	4 SWS	5

Submodule		Submodule abbreviation	
Business Administration		BW	
Responsible person		Faculty	
Prof. Dr. Alixandre Ferreira de Santana		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Alixandre Ferreira de Santana		only in winter semester	
Teaching method			
Seminar teaching with exercises (total 4 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
1.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Introduction to economic fundamentals and business administration as science.</li> <li>• Business organisation: business objectives and business typology; choice of location.</li> <li>• business processes (flow of goods, cash flows and information flow).</li> <li>• Business functions: Marketing; production; materials management; investment and financing; accounting.</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• explain the business structure (1).</li> <li>• describe the factors of production and the operational functions of procurement, production, sales, investment, financing and accounting (2).</li> <li>• understand the possibility of data processing to support the operational functions (3).</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• to critically reflect on the course content in discussions and consciously integrate it into their own value system (2).</li> <li>• apply their expertise to current business topics (3).</li> <li>• to work goal-oriented in exercise groups on topics related to business administration (ability to work in a team) and to discuss the elaborated results in the auditorium (3).</li> </ul>



Teaching materials offered
PDF, Literature
Teaching media
Blackboard, notebook, projector
Literature
<ul style="list-style-type: none"><li>• Own script and exercises</li><li>• Thommen, Jean-Paul &amp; Achleitner, Ann-Kristin: Allgemeine Betriebswirtschaftslehre, latest edition, Gabler, Wiesbaden</li><li>• Straub, Thomas: Einführung in die Allgemeine Betriebswirtschaftslehre, latest edition, Pearson, Munich</li><li>• Wöhe, Günter: Einführung in die Allgemeine Betriebswirtschaftslehre, latest edition, Vahlen, Munich</li></ul>
More information about the course
This module can be substituted by the VHB course "Fundamentals of Business Administration".

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Computer Systems		
Person responsible for the module	Faculty	
Beate Mielke (LBA)	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
2.	1.	mandatory	5

Mandatory requirements
no prerequisites necessary
Recommended previous knowledge
Programming 1 (C Programming)

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Computer Systems	4 SWS	5

Submodule		Submodule abbreviation	
Computer Systems		CS	
Responsible person		Faculty	
Beate Mielke (LBA)		Computer Science and Mathematics	
Lecturer		Availability of module	
Beate Mielke (LBA)		only in summer semester	
Teaching method			
Seminar teaching (2 SWS), exercises and practical course (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
2.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Overview of how a computer works and important relationships</li> <li>• Representation of data (char, int, floating-point) and arithmetic</li> <li>• Instruction Set Architecture</li> <li>• Assembler programming</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• show (1) and explain (2) the basic structure, functioning and interrelationships of computer systems</li> <li>• show the representation of data and information (1)</li> <li>• apply (binary) arithmetic (2)</li> <li>• describe elementary commands of computer systems (2), explain the connection to the architecture (2), and explain (2) the connection to high-level languages (C)</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• discuss subject content in small groups (2)</li> <li>• organise the learning process (time management) by oneself (2)</li> <li>• acquire new content through self-study (2)</li> <li>• solve individual tasks (2) and deal with constructive criticism (2)</li> <li>• reproduce technical contexts in correct technical language (3)</li> </ul>

<b>Teaching media</b>
Beamer, slides / script, blackboard, notebook
<b>Literature</b>
<ul style="list-style-type: none"><li>• own slides / documents</li><li>• Bryant_Computer Systems, A Programmer's View_Pearson_3rded</li><li>• Tanenbaum_Structured Computer Organisation</li><li>• Blum_Professional Assembly Language</li><li>• Seyfrath_Introduction to 64 Bit Intel Assembler Programming for Linux</li><li>• Seyfrath_Introduction to 64 bit Windows assembly language programming</li><li>• Irvine_Assembler language for x86 processors</li><li>• Kusswurm_Modern x86 assembler programming</li><li>• Intel_sdm-vol-1_basic architecture</li><li>• Intel_sdm-vol-2abcd_instruction set architecture</li><li>• Intel_sdm-vol-3abcd_system programming guide</li></ul>
<b>More information about the course</b>
Recommended previous knowledge: C Programming (Programming 1)

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Language Track A -German as a foreign language 1		
Person responsible for the module	Faculty	
Dean of Studies	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
1.	1.	mandatory	5

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track A -German as a foreign language 1: German A1	4 SWS	5

Submodule		Submodule abbreviation	
Language Track A –German as a foreign language 1: German A 1		LTA 1	
Responsible person		Faculty	
Dean of Studies		Computer Science and Mathematics	
Lecturer		Availability of module	
Christine König (LB) Olesia Sättele (LB)		only in winter semester	
Teaching method			
Seminar teaching (2 SWS) with exercises (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
1.	4 SWS	german/english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam: 90 minutes

Content
<p>Acquisition of basic knowledge of the German language. Students</p> <ul style="list-style-type: none"> <li>- learn and practise adjective comparison</li> <li>- acquire the use of numbers, including ordinal numbers</li> <li>- learn the rules of German syntax, W-questions and sentence questions</li> <li>- acquire new vocabulary from different topics (In German class, At the market, My family and I, Seasons)</li> <li>- practise and learn German phonetics</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• use solid basic knowledge of German grammar and vocabulary in everyday life (3).</li> <li>• apply basic knowledge of sentence and question formation (3).</li> <li>• use noun declension with definite, indefinite and possessive articles as well as adjective comparison (3).</li> <li>• use the conjugation of strong verbs, the formation of the past tense of "to be" and the perfect tense of weak verbs, as well as the use and conjugation of modal verbs (3).</li> <li>• understand and write simple, correct texts (3).</li> <li>• have a simple conversation (3).</li> </ul>

<b>Teaching media</b>
Course book, CD to the course book (audio exercises - phonetics, listening comprehension), Power Point for presentations
<b>Literature</b>
„Motive“ (Wilfried Krenn, Herbert Puchta) – Deutsch als Fremdsprache <ul style="list-style-type: none"><li>• Kursbuch (ISBN 978-3-19-001880-2)</li><li>• Arbeitsbuch (ISBN 978-3-19-031880-3)</li></ul> Language level A1 (8 chapters); students have to buy the textbooks themselves (10.50# and 12.00#), later rental possible.

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Language Track A -German as a foreign language 2		
Person responsible for the module	Faculty	
Dean of Studies	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
2.	1.	mandatory	5

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track A -German as a foreign language 2: German A2	4 SWS	5



Submodule		Submodule abbreviation	
Language Track A -German as a foreign language 2: German A2		LTA2	
Responsible person		Faculty	
Dean of Studies		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
Seminar teaching (2 SWS) with exercises (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
2.	4 SWS	german/english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Written exam 90 minutes

Content
The textbook "Spektrum A2+" contains vocabulary and essential linguistic structures, interesting topics and dialogues and texts that are particularly relevant for everyday life, work and study. It is important to be present at the weekly class meetings, to work on further exercises at home and to correct them independently using the solutions provided, as the course has a very steep progression.
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"> <li>• understand reading and listening texts at A2 level (3).</li> <li>• master oral and written communication in everyday situations (3).</li> <li>• master A2 structures and their practical use in the language (3).</li> <li>• use relevant idioms and vocabulary in context (3).</li> </ul>
Teaching materials offered
Supplements to the Coursebook
Teaching media
Course book with solutions booklet (to be bought by the participants themselves); audio files online,online exercises

## Literature

Course textbook: To be obtained by all participants in good time before the start of the course.  
Buscha Anne und Szilvia Szita: SPEKTRUM DEUTSCH A2+ Teilband 1, Kapitel 1–6, Schubert-Verlag, 148 Seiten, ohne CD ISBN 978-3-941323-38-4

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

<b>Module title</b>		<b>Module code</b>	
Language Track B - Part 1			
<b>Person responsible for the module</b>		<b>Faculty</b>	
Dean of Studies		Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
1.	1.	mandatory	5

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track B - Part 1: Spanish A1	4 SWS	5

Submodule		Submodule abbreviation	
Language Track B - Part 1: Spanish A1		LTB1	
Responsible person		Faculty	
Dean of Studies		Computer Science and Mathematics	
Lecturer		Availability of module	
Birgit Honikel (LB) Leticia Menéndez (LB)		only in winter semester	
Teaching method			
Seminar teaching (2 SWS) with exercises (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
1.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

#### Method of assessment

Usually written exam 90 minutes, oral exam 20 minutes;  
in digital semesters: two short written exams (1 portfolio essay, 1 THE), oral exam 20 min.

#### Content

- To provide a basic knowledge of the Spanish language at CEFR level A1 as well as basic knowledge of the regional studies of Spanish-speaking countries.
- Simple texts and audio examples form the basis for the production of text and spoken language in familiar contexts from everyday life and student life.

#### Learning objectives: Subject competence

After successful completion of the submodule, students are able to,

- express themselves with frequently used phrases and in simple language in the core areas of listening, reading, speaking, negotiating and writing (3).
- Use the basic structures of Spanish grammar, especially the different forms of the verb (presente, gerundio, perfecto, futuro) (3).
- Use learning strategies to help develop their knowledge (3).

#### Learning objectives: Personal competence

After successful completion of the submodule, students are able to,

- express themselves orally and in writing in familiar everyday situations (2).
- be able to introduce oneself and others and to orientate oneself (2).
- give information about origin, education and local area (2).
- Name cities and countries (1).

- Make appointments, give personal and family information, order in restaurants, go shopping, describe routes and one's own home, express personal interests and preferences (2).
- Express plans and opinions, talk about everyday experiences in the present and the near past (2).
- Be able to move fundamentally in the cultural context of the Spanish-speaking world (3).

#### Literature

Textbook Universo.ele A1 (Lektionen 1-7) und Lektion 8 von Universo.ele A2 (Hueber Verlag)

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Language Track B - Part 2		
Person responsible for the module	Faculty	
Dean of Studies	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
2.	1.	mandatory	5

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track B - Part 2: Spanish A2	4 SWS	5

Submodule		Submodule abbreviation	
Language Track B - Part 2: Spanish A2		LTB2	
Responsible person		Faculty	
Dean of Studies		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
seminar teaching (2 SWS) with exercises (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
2.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Usually written examination 90 minutes, oral examination 20 minutes; in digital semesters: 1 THE 30 minutes, oral examination 20 minutes.
Approved Aids for Evidence of Achievement
none

Content
<ul style="list-style-type: none"> <li>Consolidation and expansion of the expressive skills of CEFR level A1</li> <li>Basic historical and socio-cultural information, e.g. on the recent history of Spain, Latin American literature, internships and studies in Spanish-speaking countries.</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>be able to express themselves in a more complex way in the core areas of listening comprehension, reading comprehension, speaking, negotiating and writing (3).</li> <li>Already use more complex structures of Spanish grammar: different past tense forms of the verb (perfecto, indefinido, imperfecto), object pronouns, imperative, etc. (3).</li> <li>To be able to embed the corresponding vocabulary in the grammar structures in a more differentiated way (3).</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>Understand and write classified ads (2).</li> <li>formulate one's own biography and curriculum vitae and apply for an internship or a study semester abroad (2).</li> </ul>

- tell about experiences in the past (2).
- understand press, travel and historical information (2).
- express physical and psychological well-being (among friends, at the doctor's) (2).
- Give advice in familiar areas of life (food, health, learning methods) (2).

#### Literature

Textbook: Universo.ele A2, ab Lektion 9 (Hueber Verlag)

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application



Module title		Module code
Mathematics 1		
Person responsible for the module	Faculty	
Prof. Dr. Rainer Löschel	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
1.	1.	mandatory	7

Mandatory requirements
none
Recommended previous knowledge
Pre- and bridge courses

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Mathematics 1 (Linear Algebra)	6 SWS	7

Submodule		Submodule abbreviation	
Mathematics 1 (Linear Algebra) (Mathematics 1)		MA 1	
Responsible person		Faculty	
Prof. Dr. Rainer Löschel		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Stefan Körkel		only in winter semester	
Teaching method			
Seminar teaching (4 SWS) with integrated exercises (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
1.	6 SWS	english	7

#### Study hours required

Hours in attendance/lectures	Hours for self-study
90h	120h

Method of assessment
written exam 90 min

Content
<ul style="list-style-type: none"> <li>- Fundamentals of logic: set theory, propositional logic and methods of proof.</li> <li>- Algebraic structures: relations, groups, rings, fields</li> <li>- Systems of linear equations: homogeneous, inhomogeneous; Gaussian elimination</li> <li>- Vectors and matrices: linear combinations, linear independence</li> <li>- Vector spaces: subspaces, basis and dimension, norm and scalar product</li> <li>- Linear maps: Image, kernel, composition; orthogonal maps</li> <li>- Quadratic matrices: inverse matrix, determinant, principal axis theorem</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>- understand the concepts of linear algebra (3),</li> <li>- recognise the connections with other fields (e.g. analysis, numerical mathematics, technology and economics) (1),</li> <li>- be able to apply methods of linear algebra (3).</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>- communicate professionally (2),</li> <li>- work on problems analytically and independently (2).</li> </ul>

Teaching media
Blackboard, projector, mathematical software
Literature
<ul style="list-style-type: none"><li>- Dirk Hachenberger: Mathematik für Informatiker</li><li>- Rod Haggarty: Diskrete Mathematik für Informatiker</li><li>- Peter Hartmann: Mathematik für Informatiker</li><li>- David Lay: Linear Algebra and its Applications</li><li>- Gerald Teschl, Susanne Teschl: Mathematik für Informatiker, Band 1: Diskrete Mathematik und Lineare Algebra, Springer</li><li>- Edmund Weitz: Konkrete Mathematik (nicht nur) für Informatiker, Springer</li></ul>

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Mathematics 2		
Person responsible for the module	Faculty	
Prof. Dr. Martin Pohl	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
2.	1.	mandatory	7

Mandatory requirements
no prerequisites necessary
Recommended previous knowledge
Mathematics 1 and Bridge Courses

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Mathematics 2	6 SWS	7

Submodule		Submodule abbreviation	
Mathematics 2		MA2	
Responsible person		Faculty	
Prof. Dr. Martin Pohl		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
Seminar teaching (4 SWS) with exercises (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
2.	6 SWS		7

Study hours required

Hours in attendance/lectures	Hours for self-study
90h	120h

Method of assessment
Written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>Sequences and series (including convergence terms - convergence criteria for sequences and series - function series).</li> <li>Continuity (e.g. continuity concepts - intermediate value theorem)</li> <li>Differential calculus (e.g. differentiation rules - mean value theorem of differential calculus - extreme values)</li> <li>Integral Calculus (e.g. Riemann's Integral - Mean Value Theorem of Integral Calculus - Main Theorem of Differential and Integral Calculus - Integration Rules)</li> <li>Multidimensional analysis (e.g. functions in several variables - limits and continuity - differentiability, total and partial derivative - extreme values)</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>determine the behaviour of a given sequence of numbers (2).</li> <li>examine number sequences for the applicability of the various convergence criteria (3) and determine the convergence behaviour (2).</li> <li>explain the definition of elementary functions using power series (1).</li> <li>describe the concept of the derivative (1) and explain the meaning of the derivative (2).</li> <li>calculate the derivatives of given functions (2).</li> <li>analyse the behaviour of functions with the help of the central theorems of calculus (e.g. intermediate value theorem or mean value theorem) (3).</li> <li>solve application problems for differential calculus (2) and examine the solution for plausibility (3).</li> </ul>

- describe the definition of the Riemann integral (1) and explain the meaning of the Riemann integral in different fields of application (2).
- to carry out the elementary integration methods (e.g. partial integration and integration by substitution) (2).
- to recognise the connections between differential calculus and integral calculus (2).
- solve application problems for integral calculus (2) and examine the result for plausibility (3).
- describe the concept of partial differentiability (1).
- explain the geometric meaning of gradients (2) and use them in application tasks (2).
- name methods for calculating local and global extrema (1).
- analyse (3) and solve (3) application tasks for calculating extreme values.

#### Learning objectives: Personal competence

After successful completion of the submodule, students are able to,

- discuss subject matter in learning groups (2).
- analyse the arguments of others (3).
- evaluate the learning process in learning groups (3).
- name different learning methods (1).
- formulate exactly what they did not understand (2).
- to work out new contents in self-study (2).
- evaluate the personal benefit of different learning methods (3).
- analyse their own learning progress and learning needs (3).
- organise their learning process (time management) independently (2).
- present mathematical relationships in their own words (2).
- recognise their level of knowledge and learning needs (2).

#### Teaching media

Blackboard, procector, use of mathematical software

#### Literature

- Hachenberger, D.: Mathematik für Informatiker, Pearson Studium
- Hartmann, P.: Mathematik für Informatiker, Springer Vieweg Verlag (\*)
- Heuser, H: Lehrbuch der Analysis (2 Bände), Vieweg + Teubner Verlag
- James Stewart, J.: Essential Calculus, Brooks/Cole
- Teschl, G. und S.: Mathematik für Informatiker, Band 2: Analysis und Statistik, SpringerVerlag (\*)
- Thomas, G.B., Weir, M.D., Hass, J.: Basisbuch Analysis, Pearson Studium (\*\*)
- Weitz, E.: Konkrete Mathematik (nicht nur) für Informatiker, Springer Verlag (\*)

For the books marked with (\*), access to the pdf version is possible via the university library of the OTH Regensburg. For the book marked with (\*\*), online access is possible via the university library of the OTH Regensburg.

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Networking		
Person responsible for the module	Faculty	
Prof. Dr. Sebastian Fischer	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
2.	1.	mandatory	5

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Programming 1

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Networking	4 SWS	5

Submodule		Submodule abbreviation	
Networking		NW	
Responsible person		Faculty	
Prof. Dr. Sebastian Fischer		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Sebastian Fischer		only in summer semester	
Teaching method			
Seminar teaching (2 SWS) with practical training (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
2.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Overview of computer networks (components, operation, protocols, timing of data transmission, network architecture models: ISO - OSI, TCP/IP).</li> <li>• Application layer (communication between processes, services for network applications, protocol flow and message formats of applications: HTTP, FTP, e-mail, DNS)</li> <li>• Transport layer (protocol types: TCP, UDP, message formats, flow, congestion control, analysis)</li> <li>• Network layer (network service model, routing, distance vector algorithm, link state algorithm, hierarchical routing, routing tables, routing protocols: RIP, OSPF, BGP, addressing in TCP/IP networks, IPv4 protocol: message format, fragmentation, flow, analysis, subnetting)</li> <li>• Data Link (DL) layer (services of the DL layer, techniques for error correction, secured and unsecured transmission protocols: Stop &amp; Wait, Go Back to N, multiple access protocols, ARP protocol, DL for LANs: Ethernet, Fast Ethernet, Gigabit Ethernet, wireless access methods: IEEE 802.11, network components of the DL: bridge, hub, switches)</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• specify network components, their roles and the communication protocols between components (1),</li> <li>• name the standard ISO-OSI architecture model compared to the TCP/IP model (1), and use different application layer network services (such as DNS, DHCP) (2).</li> <li>• analyse (3) and identify (1) message content using analysis tools in the lab,</li> </ul>



<ul style="list-style-type: none"><li>• name the protocols of the transport layer (TCP, UDP) and the most important services of the network layer, such as routing and global addressing (1), and can practically apply them to network components, such as routers and switches (2),</li><li>• list the most commonly used methods for message transmission within the data link layer (1)</li></ul>
<b>Learning objectives: Personal competence</b>
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"><li>• present technical content in front of an audience (2),</li><li>• ask technical questions (3) and</li><li>• reproduce network-related contexts in correct technical language (3).</li></ul>
<b>Teaching media</b>
Blackboard, notebook, projector
<b>Literature</b>
<ul style="list-style-type: none"><li>• Lecture slides and tutorials</li><li>• Fred Halsall: Computer Networking and the Internet, Addison Wesley, Reading,MA.</li><li>• Behrouz Forouzan: Data Communications and Networking, McGrawHill,Boston</li></ul>

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Programming 1		
Person responsible for the module	Faculty	
Prof. Dr. Sebastian Fischer	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
1.	1.	mandatory	8

Mandatory requirements
No previous knowledge required
Recommended previous knowledge
No previous knowledge required

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Programming 1	6 SWS	8

Submodule		Submodule abbreviation	
Programming 1		PG1	
Responsible person		Faculty	
Prof. Dr. Sebastian Fischer		Computer Science and Mathematics	
Lecturer		Availability of module	
Beate Mielke (LBA)		only in winter semester	
Teaching method			
Seminar teaching (4 SWS) and tutorial (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
1	6 SWS	english	8

#### Study hours required

Hours in attendance/lectures	Hours for self-study
90h	150h

Method of assessment
written exam 90 minutes

Content
<ul style="list-style-type: none"> <li>- Coding, compiling, linking and debugging (with and without IDE) program structure / modules</li> <li>- Statements, expressions</li> <li>- Data types, variables, constants and their visibility</li> <li>- Standard input/output functions</li> <li>- Operators (including arithmetic, relational, logical, bit operators)</li> <li>- Preprocessor</li> <li>- Control structures</li> <li>- Array handling</li> <li>- String handling</li> <li>- Functions (e.g. main with/without arguments) call by value, call by reference</li> <li>- Recursive functions</li> <li>- Variable qualifiers (const, external, static, volatile)</li> <li>- Pointers (including double pointers and functions, pointer arithmetic)</li> <li>- User-defined data types (e.g. enum, struct, union, typedef)</li> <li>- Dynamic memory management (malloc, realloc, free)</li> <li>- Linked lists</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <p>... understand the concepts of procedural languages (1)</p> <p>... understand and apply the syntax of the programming language C (3)</p>

... understand the operation of unknown procedural programs by analyzing the source code and find errors (2)  
... analyze simple problems, implement and test algorithms for solving them in the procedural programming language C (3)  
... know elementary data structures and apply them independently (2)

#### Learning objectives: Personal competence

After successful completion of the submodule, students are able to,  
... to ask the lecturer technical questions and to reproduce the contents of the lecture in correct technical language (2)  
... develop their own solution strategies for exercises (3)  
... work persistently on a task (2)  
... to work carefully and accurately (2)

#### Teaching media

Blackboard, notebook, projector

#### Literature

- Dennis Ritchie, Brian Kernighan, The C Programming Language, 2nd edition, 1990  
- Jürgen Wolff / René Kroß: C von A bis Z: Das umfassende Handbuch für C-Programmierer. Zum Lernen und Nachschlagen. Aktuell zum Standard C18 Rheinwerk-computing, 4th edition, 2020 (German book)

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Programming 2		
Person responsible for the module	Faculty	
Prof. Felix Schwägerl	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
2.	1.	mandatory	8

Mandatory requirements
no prerequisites necessary
Recommended previous knowledge
Programming 1

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Programming 2	6 SWS	8

Submodule		Submodule abbreviation	
Programming 2		PG2	
Responsible person		Faculty	
Prof. Felix Schwägerl		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Felix Schwägerl		only in summer semester	
Teaching method			
Seminar teaching with exercises (4 SWS) and practical course (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
2.	6 SWS	english	8

#### Study hours required

Hours in attendance/lectures	Hours for self-study
90h	150h

Method of assessment
Written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Characterization of procedural, object-oriented, and functional programming languages</li> <li>• Development and runtime environment (compiler, bytecode, garbage collection)</li> <li>• Data types (primitives, arrays, enums, classes, reference types, and null)</li> <li>• Syntactic foundations (comments, declarations, expressions, statements)</li> <li>• Classes and objects (encapsulation, fields and methods, visibilities, constructors, static members)</li> <li>• Inheritance (field/method/constructor inheritance, abstract classes, interfaces)</li> <li>• Polymorphism (late binding, up-/downcasts)</li> <li>• Generics (generic methods, generic classes, bounded generics, collections)</li> <li>• Exceptions (causing and handling)</li> <li>• Functional programming (lambda expressions, method references, streams)</li> <li>• Structuring larger programs (Packages and modules)</li> <li>• Concurrency and multithreading</li> <li>• Graphical user interfaces and file input/output</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• Explain the basic features of object-oriented programming, and how they are offered by a concrete object-oriented programming language (1).</li> <li>• Transfer the learned principles to other object-oriented programming languages (2).</li> </ul>

- Logically grasp problems of medium complexity, design and implement an algorithmic solution in an object-oriented programming language (3).
- Use development tools (compiler, editor, IDE) purposefully (2).
- Make adequate use of libraries and frameworks in order to solve complex problems (2).
- Understand and extend existing software written in an object-oriented programming language (3).
- Master common development tools to edit, compile, debug, and test source code in projects of manageable size (2).

**Learning objectives: Personal competence**

After successful completion of the submodule, students are able to,

- Name the benefits and limitations of object-oriented programming (1) and assess its suitability for a given project (2).
- Familiarize themselves with new languages, tools, frameworks, and ecosystems of object-oriented programming (2).
- Transfer solution approaches learned in the practical course to similar problems (3).
- Document own programs adequately and know how to use documentation of existing software for building on top of it (2).
- Assess existing source code, find weaknesses, and develop strategies for improvement (2).
- Integrate into a small software development team and implement parts of the software independently while communicating progress and problems adequately and efficiently (3). Recognize deficits in their own learning process, to communicate them, and to make use of the offered assistance (2).

**Teaching materials offered**

Copies of slides, exercises, code examples

**Teaching media**

Laptop, beamer, blackboard

**Literature**

- Kathy Sierra, Bert Bates, Trisha Gee: Head First Java, 3rd edition, O'Reilly, 2022
- B.J. Evans, Jason Clark, David Flanagan – Java in a Nutshell, 8th edition, O'Reilly, 2023
- David Parsons – Foundational Java, 2nd edition, Springer, 2020
- Joshua Bloch – Effective Java, 3rd edition, Pearson, 2018
- James Gosling et al.: The Java Language Specification – Java SE 21 edition, 2023

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Algorithms and Data Structures		
Person responsible for the module	Faculty	
Prof. Dr. Klaus Volbert	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
4.	2.	mandatory	8

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Programming 1 and Programming 2

Content
see next page

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Algorithms and Data Structures	6 SWS	8



Submodule		Submodule abbreviation	
Algorithms and Data Structures		AD	
Responsible person		Faculty	
Prof. Dr. Klaus Volbert		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
Seminar-based teaching (4 SWS) with exercises (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
4.	6 SWS	english	8

#### Study hours required

Hours in attendance/lectures	Hours for self-study
90h	150h

Method of assessment
Written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Complexity analysis (models for runtime and memory analysis, best, average and worst case analysis, complexity classes, asymptotic complexity, solving recursion equations).</li> <li>• Design methods (divide and conquer, dynamic programming, greedy algorithms, backtracking)</li> <li>• Algorithms for standard problems (elementary, advanced and key-based sorting methods, data structures for managing sets - e.g. binary search trees, balanced trees, queues, hashing, searching in sets and strings, graph algorithms - e.g. depth and breadth-first search, shortest paths, minimal spanning trees)</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to, reproduce and implement basic algorithms and data structures for standard problems (1). They can evaluate and compare the efficiency of algorithms and data structures (2). They have understood how efficient algorithms and data structures can be analysed and designed on the basis of the design principles they have learned (3).</p>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to, independently reproduce (1), process (2) and solve (3) algorithmic problems on fundamental topics in computer science alone and in group work.</p>

They can evaluate and compare their own and other solutions.

#### Teaching media

Blackboard, notebook, projector

#### Literature

- Cormen, T. H., Leisserson, C. E., Rivest, R.L., Stein, C.: Introduction to Algorithms, MIT Press, 2022
- Kleinberg, J., Tardos, E.: Algorithm Design, Pearson Education Limited, 2013
- Ottmann, T., Widmayer, P.: Algorithmen und Datenstrukturen, Springer Vieweg, 2017
- Pomberger, G., Dobler, H.: Algorithmen und Datenstrukturen, Pearson Studium 2008
- Schöning, U.: Algorithmik, Spektrum Akademischer Verlag, 2011
- Sedgewick, R.: Algorithms, Addison Wesley, 2011
- Solymosi, A., Grude, U.: Grundkurs Algorithmen und Datenstrukturen in JAVA: Eine Einführung in die praktische Informatik, Vieweg, 2017

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Computer Architecture		
Person responsible for the module	Faculty	
Prof. Dr. Sebastian Fischer	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
4.	2.	mandatory	7

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Computer Systems

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Computer Architecture	6 SWS	7

Submodule		Submodule abbreviation	
Computer Architecture		CA	
Responsible person		Faculty	
Prof. Dr. Sebastian Fischer		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Sebastian Fischer		only in summer semester	
Teaching method			
Seminar-based teaching (4 SWS) with exercises and practical training (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
4.	6 SWS	english	7

Study hours required

Hours in attendance/lectures	Hours for self-study
90h	120h

Method of assessment
Written exam 90 minutes or project report and presentation

Content
<ul style="list-style-type: none"> <li>• Microprocessor Design: Analysis of existing microprocessor architectures (RISC, CISC) with a focus on optimisation technologies like hyperthreading, multiprocessing, etc.</li> <li>• Integration of Advanced Algorithms into Hardware: Exploration of embedding advanced computational methods directly into hardware architecture.</li> <li>• Architecture and Programming of Multi-Processor Systems: Study of design, synchronization, and challenges in multi-processor and multi-core systems, including an overview of novel computing architectures.</li> <li>• Memory Hierarchy and Future Storage Technologies</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• understand the core principles of various microprocessor architectures (3),</li> <li>• analyze the integration of algorithms into hardware (3),</li> <li>• evaluate design and synchronization strategies in multi-processor systems (3),</li> <li>• recognize the role of memory hierarchy and the impact of future storage technologies on system performance (2).</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• to familiarise themselves independently and with motivation with new topics and to work on them in a structured and step-by-step manner with given documents (2)</li> </ul>

- to apply learned solution approaches on the basis of given exercises and example tasks with the help of their own creativity and imagination to other scenarios in their own field of experience (3)
- to recognise own deficits in learning progress, to communicate this and to use the possibilities of the offered assistance (2)

#### Teaching media

Blackboard, notebook, projector

#### Literature

- lecture slides
- Andrew S. Tanenbaum, Todd Austin, Structured computer organization, 6th edition, Pearson 2023

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Databases		
Person responsible for the module	Faculty	
Prof. Dr. Johannes Schildgen	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
3./4.	2.	mandatory	7

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Good programming skills in C, Java or C++ Theoretical computer science

Content
see next page

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Databases	6 SWS	7

Submodule		Submodule abbreviation	
Databases		DAB	
Responsible person		Faculty	
Prof. Dr. Johannes Schildgen		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Johannes Schildgen		only in winter semester	
Teaching method			
Seminar teaching (4 SWS) with exercises (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
3.	6 SWS	english	7

#### Study hours required

Hours in attendance/lectures	Hours for self-study
90h	120h

Method of assessment
Written exam: 90 minutes

Content
<p>Conceptual data modelling: entity-relationship model.</p> <ul style="list-style-type: none"> <li>• Relational model: Relational algebra and normal forms.</li> <li>• SQL: database query language, data definition language (DDL, DML), views, rights management.</li> <li>• Database programming: transactions, accessing databases with suitable programming languages, user-defined functions, triggers.</li> <li>• Concurrency and database recovery: logging and recovery, concurrency, locking mechanisms, deadlocks.</li> <li>• Database optimisation: query optimisation, indexes.</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• explain the functional principles of databases (1),</li> <li>• design small to medium-sized databases conceptually and logically (2),</li> <li>• set up (2) and use databases with the query language SQL. (2),</li> <li>• evaluate concepts such as views, triggers and user-defined functions (3) and select adequate concepts for specific use cases (3).</li> </ul>

<b>Learning objectives: Personal competence</b>
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"><li>• model in cooperation with other databases -&gt; plan databases in a team (3)</li></ul>
<b>Teaching media</b>
Blackboard, projector, notebook
<b>Literature</b>
<ul style="list-style-type: none"><li>• C.J. Date: Introduction to Database Systems, Addison Wesley, 2003</li></ul>

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application



Module title		Module code
General science compulsory elective module 1		
Person responsible for the module	Faculty	
Prof. Dr. Gabriele Blod		

Semester taught according to the curriculum	Level of study	Module type	Credit value
5.	2.	mandatory elective	2

Mandatory requirements
usually none, except for courses that build on each other
Recommended previous knowledge
usually none, except for courses that build on each other

Content
<ul style="list-style-type: none"> <li>• Imparting orientation knowledge and general education</li> <li>• Teaching and training of key competences (e.g. additional certificate "Soft Skills")</li> <li>• Teaching and training of foreign languages</li> </ul>

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	General science compulsory elective module 1	2 SWS	2

Submodule		Submodule abbreviation	
General science compulsory elective module 1		AW1	
Responsible person		Faculty	
Prof. Dr. Gabriele Blod		Angewandte Natur- und Kulturwissenschaften	
Lecturer		Availability of module	
N.N.		only in winter semester	
Teaching method			
Depending on the selected general science elective module (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
5.	2 SWS	german/english	2

#### Study hours required

Hours in attendance/lectures	Hours for self-study
30h	30h

Method of assessment
Written examination and/or seminar paper and/or oral examination

Content
Depending on the respective course
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, understand and apply the professional competences described in the respective course description.
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, intellectually classify and practically implement the personal competences described in the respective course description.
Teaching media
Depending on the respective course
Literature
Depending on the respective course

### More information about the course

The general science elective module 1 can be freely selected from the entire general science elective offer with the following exceptions:

- Modules from the area of EDP
- Modules from the VHB of the subject area Internet Literacy or other IT-related subjects.
- Module "3-D printing" from the area of natural science and technology

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
General science compulsory elective module 2		
Person responsible for the module	Faculty	
Prof. Dr. Gabriele Blod		

Semester taught according to the curriculum	Level of study	Module type	Credit value
5.	2.	mandatory elective	2

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
usually none, except for courses that build on each other

Content
<ul style="list-style-type: none"> <li>• Imparting orientation knowledge and general education</li> <li>• Teaching and training of key competences (e.g. additional certificate "Soft Skills")</li> <li>• Teaching and training of (foreign) languages</li> </ul>

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	General science compulsory elective module 2	2 SWS	2

Submodule		Submodule abbreviation
General science compulsory elective module 2		AW2
Responsible person	Faculty	
Prof. Dr. Gabriele Blod	Angewandte Natur- und Kulturwissenschaften	
Lecturer	Availability of module	
N.N.	only in winter semester	
Teaching method		
Depending on the selected general science elective module		

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
5.	2 SWS	german/english	2

#### Study hours required

Hours in attendance/lectures	Hours for self-study
30h	30h

Method of assessment
Written examination and/or seminar paper and/or oral examination

Content
Depending on the respective course
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, understand and apply the professional competences described in the respective course description.
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, intellectually classify and practically implement the personal competences described in the respective course description.
Teaching media
Depending on the respective course

<b>Literature</b>
Depending on the respective course
<b>More information about the course</b>
General science compulsory elective module 2: The following courses are recognised: <ul style="list-style-type: none"><li>• Social and methodological competence: blocks 1 - 4 (not block 5)</li><li>• Social competence</li><li>• Additional studies in international competence (if at least two courses have been attended, not only the lecture in WiSe)</li><li>• International rhetorical competence (IRK): Communicating with others (conversation and moderation G1 - G5)</li><li>• Oral Communication and Speech Training: Oral Communication II</li></ul>

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Global Software Engineering		
Person responsible for the module	Faculty	
Prof. Felix Schwägerl	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
3.	2.	mandatory	8

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Programming 1 and Programming 2

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Global Software Engineering	6 SWS	8

Submodule		Submodule abbreviation	
Global Software Engineering		GSE	
Responsible person		Faculty	
Prof. Felix Schwägerl		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Carsten Kern Prof. Felix Schwägerl		only in winter semester	
Teaching method			
Seminar teaching with exercises (4 SWS) and practical course (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
3.	6 SWS	english	8

#### Study hours required

Hours in attendance/lectures	Hours for self-study
90h	150h

Method of assessment
Written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Basics of software engineering (motivation, definitions, ethics, role of models)</li> <li>• Phases, disciplines, and processes (phase models, iterative, spiral model, V model)</li> <li>• Agile software development (manifesto, principles, Scrum, empirical process improvement)</li> <li>• Requirements engineering (definitions, gathering techniques, attributes, templates)</li> <li>• Object-oriented analysis (use case models, domain models, behavior/interaction models)</li> <li>• Software architecture (views, evaluation criteria, architectural styles, documentation)</li> <li>• Fine-grained design (refinement, implementation in Java, design principles, design patterns)</li> <li>• Testing (regression, refactoring, unit tests, code coverage, test-driven development)</li> <li>• Quality assurance (verification/validation, coverage, continuous integration, acceptance tests)</li> <li>• Deployment and maintenance (delivery, software evolution, predictive maintenance)</li> <li>• DevOps engineering (continuous deployment, containers, infrastructure as code, monitoring)</li> <li>• Project management and planning (risk management, team management, cost estimation)</li> <li>• Software version management (revision logs, branching, tagging, conflict resolution)</li> <li>• Global software development (motivations, socio-technical challenges, methods, tools)</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• Know and reproduce the ways of thinking and procedures of software engineering (1).</li> </ul>



- Express awareness about the importance, difficulties and possibilities of software engineering and its disciplines (1).
- Select, tailor, and improve the software development process suitable for a specific project or product (2).
- Use standardized modeling notations on an adequate level of detail and utilize models' ability to break down software engineering tasks by abstracting from requirements, software, and hardware (3).
- Document the results of requirements engineering, object-oriented analysis and fine-grained design using adequate language, terms, and formalisms (2).
- Systematically specify, design, implement, verify, and deliver a software system with limited extent using suitable engineering methodologies and an object-oriented programming language like Java (3).
- Apply appropriate software quality assurance metrics, methods, and tools to existing systems or systems under development (2).
- Select and apply suitable methods and tools for project management, software maintenance, and software version management (3).
- Explain (1) and classify (2) the specific challenges, methods, and tools occurring in international, intercultural, and interdisciplinary software engineering teams.

**Learning objectives: Personal competence**

After successful completion of the submodule, students are able to,

- Understand how the specifics of global software development impact each discipline of software engineering (1).
- Theoretically know how to collaborate with clients or managers to gather software requirements and help them make informed business decisions based on technical facts (1).
- Ask the crucial questions for being able to select adequate methods and tools for each discipline of software engineering (2).
- Assess analysis, design and implementation artifacts produced by team members according to well-defined criteria and communicate constructive feedback effectively and adequately (2).
- Coordinate the activities of software engineering teams and deal with challenges such as stress, motivation, or conflicts (2). Adopt different roles in software engineering teams with different responsibilities therein (3).

**Teaching materials offered**

Copies of slides, exercises, code examples, materials from case studies, templates

**Teaching media**

Laptop, beamer, blackboard

## Literature

- Ian Sommerville: Software Engineering, 10th edition, Pearson, 2016
- Ian Sommerville: Engineering Software Products, Pearson, 2021
- Ken Schwaber, Jeff Sutherland: Scrum Guide, Creative Commons, 2020
- Klaus Pohl, Chris Rupp: Requirements Engineering Fundamentals, RockyNook, 2015
- Grady Booch et al.: Object-Oriented Analysis and Design with Applications, 3rd edition, Addison-Wesley, 2007
- Mark Richards, Neil Ford: Fundamentals of Software Architecture, O'Reilly, 2020
- Erich Gamma et al: Design Patterns, Addison-Wesley, 2009
- Robert C. Martin: Clean Code, Prentice Hall, 2009
- Shekhar Gulati, Rahul Sharma: Java Unit Testing with JUnit 5, Apress, 2017
- Paul Ammann, Jeff Offutt: Introduction to Software Testing, Cambridge University Press, 2016
- Gene Kim et al.: The DevOps Handbook, IT Revolution Press, 2016
- Scott Chacon, Ben Straub: Pro Git, Apress, 2014
- Pierre Bourque, Dick Fairley: Software Engineering Body of Knowledge (SWEBOK), v3, IEEE Computer Society, 2014
- James D. Herbsleb: Global software engineering in the age of GitHub and Zoom. J. Softw. Evol. Process. 35(6), 2023 [and previous work referenced by the author]

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

<b>Module title</b>		<b>Module code</b>	
Language Track A -German as a foreign language 3			
<b>Person responsible for the module</b>	<b>Faculty</b>		
Dean of Studies	Computer Science and Mathematics		

Semester taught according to the curriculum	Level of study	Module type	Credit value
3.	2.	mandatory	5

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track A -German as a foreign language 3: German B1.1	4 SWS	5

Submodule		Submodule abbreviation
Language Track A –German as a foreign language 3: German B1.1		LTA3
Responsible person	Faculty	
Dean of Studies	Computer Science and Mathematics	
Lecturer	Availability of module	
N.N.	only in winter semester	
Teaching method		
Seminar teaching (2 SWS) with exercises (2 SWS).		

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
3.	4 SWS	german/english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam: 90 minutes

Content
Based on familiar topics/situations, the students develop appropriate written and oral communicative behaviour in a playful approach, both for everyday situations and for the academic-university field. The approximation to the scientific language style facilitates access to and mastery of study-relevant topics. In addition to the accompanying treatment and expansion of the relevant vocabulary, students practise idioms, increase their grammatical competence and acquire learning strategies. Taking intercultural aspects into account, topics related to the country are dealt with, which enables a greater insight into the historical and socio-cultural conditions of Germany.
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"> <li>• cope with everyday situations (2); students have a command (appropriate to the level) of the linguistic structures and vocabulary for this.</li> <li>• recognise vocabulary and linguistic structures of scientific language style (1).</li> <li>• discuss topics of everyday life, but also of university life and studies appropriately and justify own opinions/thoughts (3).</li> <li>• independently acquire new linguistic structures by analogy with what they have already learned (3).</li> </ul>

### Literature

- Dreyer, H. / Schmitt, R. (2008) Lehr- und Übungsbuch der deutschen Grammatik. Ismaning. Max Hueber Verlag
- Buscha, A. / Szita, S. (2015) B-Grammatik. Übungsgrammatik Deutsch als Fremdsprache. Leipzig. Schubert Verlag

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Language Track A -German as a foreign language 4		
Person responsible for the module	Faculty	
Dean of Studies	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
4.	2.	mandatory	5

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track A -German as a foreign language 4: German B1.2	4 SWS	5

Submodule		Submodule abbreviation
Language Track A -German as a foreign language 4: German B1.2		LTA4
Responsible person	Faculty	
Dean of Studies	Computer Science and Mathematics	
Lecturer	Availability of module	
N.N.	only in summer semester	
Teaching method		
Seminar teaching (2 SWS) with exercises (2 SWS).		

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
4.	4 SWS	german/english	5

Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam: 90 minutes

Content
<ul style="list-style-type: none"> <li>• Listening comprehension: Comprehension of easy to moderately difficult texts and reproduction of their key messages.</li> <li>• Speaking: Participation in discussions on topics relevant to everyday life and studies.</li> </ul>
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, to passively understand and, if necessary, actively apply extended expressive possibilities, critical listening comprehension (2/3).
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, Apply presentation techniques (3).
Literature
More information about the course
Previous knowledge: Level of at least A2

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Language Track B - Part 3		
Person responsible for the module	Faculty	
Dean of Studies	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
3.	2.	mandatory	5

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track B - Part 3: Spanish B1.1	4 SWS	5



Submodule		Submodule abbreviation	
Language Track B - Part 3: Spanish B1.1		LTB3	
Responsible person		Faculty	
Dean of Studies		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in winter semester	
Teaching method			
Seminar teaching (2 SWS) with exercises (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
3.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
usually: written exam (90 min.) and oral exam (usually 20 min. for 1 person) in digital semesters: oral 30 minutes

Content
Start of CEFR level B1: independent use of language - Topics: Study conditions, forecasts, travelogues, social movements in Spanish speaking countries
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"> <li>• express themselves with greater independence in the core areas of listening, reading, speaking, negotiating and writing (2).</li> <li>• apply further structures of Spanish grammar (3): verbal periphrases, deepened and extended use of the past tense forms of the verb (perfecto, indefinido, imperfecto, pluscuamperfecto), futuro simple and condicional, subjuntivo in the present tense, etc.</li> <li>• embed the corresponding vocabulary in the grammar structures in a more differentiated way(3): discuss statistics, formulate forecasts, express wishes and opinions, report on the past in a differentiated way.</li> </ul>
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"> <li>• name their own study conditions and understand those of others (2).</li> <li>• Understand or describe statistics, make predictions and describe future plans (2).</li> <li>• report (positive and negative) experiences of travel, write and talk about them, respond to narratives in a varied way (2).</li> </ul>

- express wishes, requests and opinions in conversation and write letters to the editor (2).
- understand original texts on familiar topics (travel, study, social and political movements, economic newswatches) and comment on them to a limited extent (2).

Literature

Universo.ele B1, Lektionen 1-3 (Hueber Verlag)

More information about the course

Recommended previous knowledge: CEFR level A2

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Language Track B - Part 4		
Person responsible for the module	Faculty	
Dean of Studies	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
4.	2.	mandatory	5

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Language Track B - Part 4: Spanish B1.2	4 SWS	5

Submodule		Submodule abbreviation	
Language Track B - Part 4: Spanish B1.2		LTB4	
Responsible person		Faculty	
Dean of Studies		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
Seminar teaching (2 SWS) with exercises (2 SWS).			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
4.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
written exam 90 minutes, oral exam 20 minutes

Content
CEFR level B1, part 2: independent use of language topics: private and public contacts (language tandem, social engagement, celebrating festivals), environment (petitions)
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• express themselves with extended independence in the core areas of listening comprehension, reading comprehension, speaking, negotiating and writing (3).</li> <li>• apply further structures of Spanish grammar (3): deepened and extended use of the subjuntivo in the present tense (also for the negated imperative); repetition and deepening of the conditional, indirect speech in the present tense etc.</li> <li>• embed the corresponding vocabulary in the grammar structures in a more differentiated way (3): express wishes, feelings and opinions, formulate advice and requests, express prohibitions, use verbs of change.</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• Name interpersonal relationships (2).</li> <li>• Congratulations (2).</li> <li>• express wishes and requests as well as opinions in a differentiated way (2).</li> <li>• talk about changes (2).</li> <li>• write a petition (2).</li> </ul>

- understand, respond to, summarise or communicate original texts on environmental issues, formal and informal invitations, from exchanges (3).

#### Literature

Textbook: Universo.ele B1, Lektionen 4-6 (Hueber Verlag)  
Lecturer's script

#### More information about the course

Recommended previous knowledge: CEFR level A2 and B1.1

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Operating Systems		
Person responsible for the module	Faculty	
Prof. Dr. Markus Kucera	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
3.	2.	mandatory	5

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Programming 1 and Programming 2

Content
see next page

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Operating Systems	4 SWS	5

Submodule		Submodule abbreviation
Operating Systems		OPS
Responsible person	Faculty	
Prof. Dr. Markus Kucera	Computer Science and Mathematics	
Lecturer	Availability of module	
N.N.	only in winter semester	
Teaching method		
Seminar-based teaching (2 SWS) with exercises and practical training (2 SWS). Exercises can also be offered virtually.		

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
3.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Written exam: 90 minutes

Content
<p>Introduction (history, operating system, layer model, interfaces and virtual machine)            Processes (process states, scheduling, synchronisation, communication)            Memory management (memory allocation strategies, virtual memory, page management, segmentation, cache)            File management (file systems, file attributes, file functions, file organisation)</p>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to, deepen their knowledge also beyond the discipline and reflect on the epistemologically justified correctness of professional and practice-relevant statements in relation to the situation. These are seen in relation to the complex context and critically weighed up against each other. Students collect, evaluate and interpret relevant information and derive scientifically sound judgements. They develop approaches to solutions and realise solutions corresponding to the state of the art in science. They carry out application-oriented projects and contribute to the solution of complex tasks in a team. They independently design further learning processes. The students know the most important mechanisms of an operating system. They understand the basic concepts of a modern operating system and acquire skills in system-related programming.</p> <p>The competences are taught at level 3.</p>

### Learning objectives: Personal competence

After successful completion of the submodule, students are able to, formulate subject-specific and factual solutions to problems within their actions and can justify them in discourse with subject representatives with theoretically and methodically sound argumentation. They communicate and cooperate with other subject representatives in order to solve a task responsibly. They also reflect on and take into account different perspectives and interests of other stakeholders.

Students develop a professional self-image that is oriented towards goals and standards of professional action in predominantly non-scientific professional fields. They justify their own professional actions with theoretical and methodological knowledge and are able to assess their own abilities, they autonomously reflect on factual design and decision-making freedoms and use these under guidance. Students recognise the framework conditions of professional action appropriate to the situation and justify their decisions responsibly and ethically. They critically reflect on their professional actions in relation to social expectations and consequences.

The competences are taught at level 3.

### Teaching media

Blackboard, projector, slides

### Literature

- Tanenbaum. Moderne Betriebssysteme
- Silberschatz et al: Operating System Concepts

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application



Module title		Module code
Practical Semester		
Person responsible for the module	Faculty	
Praxisbeauftragte-r Informatik	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
5.	2.	mandatory	26

Mandatory requirements
90 credits from the previous 4 semesters or: Complete completion of the foundation modules (acquisition of 60 credit points) and completion of at least one further semester of full-time study.
Recommended previous knowledge
Successful Completion of all the foundation modules (acquisition of 60 credit points) and completion of at least one further semester of full-time study.

Content
see next page

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Industrial Placement		24
2.	Industrial Placement Seminar	2 SWS	2

Submodule		Submodule abbreviation
Industrial Placement		PR
Responsible person	Faculty	
Praxisbeauftragte-r Informatik	Computer Science and Mathematics	
Lecturer	Availability of module	
N.N.	**every semester	
Teaching method		
Internship (18 weeks full-time in the company) and practical seminar (1 day)		

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
5.		german/english	24

Study hours required

Hours in attendance/lectures	Hours for self-study

Method of assessment
Proof of 18 weeks of internship in the company, Seminar presentation with success and internship report with success

Content
In the context of IT projects, participation in as many project phases as possible (system analysis, system planning, implementation and system introduction) must be ensured.
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, to reproduce typical work/tasks from IT in a company (1). They know the working methods and work processes in a company. They have been able to practically apply and in particular deepen the specialist knowledge they acquired during their studies (2-3). They have learned how work results are discussed and presented in the company.
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, reproduce (1), process (2) and solve (3) typical work/tasks from informatics arising in a company, alone and in teams. They can evaluate and compare their own and other solutions. They have a first impression of how they can help shape the future world of work with their own contributions.

Teaching media
Practical seminar: blackboard, notebook, beamer
Literature
More information about the course
Internship and practical seminar Internship: 18 weeks, the daily working time corresponds to the usual working time of the training place for full-time employees. see: §3 Section 4 of the APO, approx. 38.5h full-time in the company (total: approx. 693h). Practical seminar (2 SWS): Attendance at seminar, preparation and follow-up work

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Submodule		Submodule abbreviation	
Industrial Placement Seminar		PS	
Responsible person		Faculty	
Praxisbeauftragte-r Informatik		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.			
Teaching method			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
5.	2 SWS	english	2

#### Study hours required

Hours in attendance/lectures	Hours for self-study

Method of assessment
Seminar presentation with success and internship report with success.

Content
Seminar presentation about the course and contents of the internship in the company and preparation of an internship report.
Teaching media
Industrial Placement Seminar: blackboard, notebook, projector
Literature
More information about the course
Industrial Placement Seminar: presence in the seminar, (preparation and follow-up)

Module title		Module code
Statistics		
Person responsible for the module	Faculty	
Prof. Dr. Hans Kiesl Prof. Dr. Peter Wirtz	Computer Science and Mathematics Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
3.	2.	mandatory	5

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Mathematics 1 and 2 Programming skills

Content
see next page

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Statistics	4 SWS	5

Submodule		Submodule abbreviation	
Statistics		ST	
Responsible person		Faculty	
Prof. Dr. Peter Wirtz Prof. Dr. Hans Kiesl		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Dr. Hans Kiesl Prof. Dr. Peter Wirtz		only in winter semester	
Teaching method			
Seminar-base teaching (4SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
3.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Written exam: 90 minutes

Content
<p><b>Descriptive statistics</b> (summarizing data, methods based on the empirical cumulative density function, measures of location, measures of dispersion, exploring relationships with scatterplots).</p> <p><b>Probability Models</b> (the idea of probability: a measure of uncertainty, probability measures, laws of probability, elementary combinatorics, conditional probabilities, Bayes theorem, independence).</p> <p><b>Random Variables and Distributions</b> (discrete and continuous random variables, expectation and variance, functions of random variables, joint distributions, covariance and correlation).</p> <p><b>Convergence and Limit theorems</b> (weak and strong laws of large numbers, the central limit theorem)</p> <p><b>Statistical Inference</b> (estimation of parameters, confidence intervals, testing hypotheses)</p>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>to explain definitions, terms and theorems of probability theory in their own words (1),</li> <li>to work on questions of probability theory independently and in a planned manner (2),</li> <li>apply basic procedures of descriptive statistics (2),</li> </ul>

- be able to assess the methodology of statistical estimation and testing procedures and apply them to practical problems (3),
- to approach stochastic applications in computer science independently and confidently (3),
- understand and classify additional statistical literature (2),
- carry out simple and more demanding statistical analyses for their own work (seminar, theses, research projects) (3).

#### Learning objectives: Personal competence

After successful completion of the submodule, students are able to,

- work in a team in a goal-oriented manner (teamwork skills) (1),
- present the results in a factual and target-oriented manner (presentation competence) (2),
- defend their point of view professionally (argumentation competence) (3),
- present their findings to target groups (adaptability) (1),
- defend their own results and opinions in front of different target groups (confidence in their own judgement) (2)
- evaluate challenging questions and work on them in a goal-oriented way (3)

#### Teaching media

Blackboard, notebook, projector

#### Literature

- Bosch, Elementare Einführung in die angewandte Statistik, Vieweg 2005
- Hübner, Stochastik: Eine anwendungsorientierte Einführung für Informatiker, Ingenieure und Mathematiker, Vieweg 2009
- Lehn/Wegmann, Einführung in die Statistik, Teubner 2006
- Ross, Statistik für Ingenieure und Naturwissenschaftler, Elsevier 2006
- Sachs, Wahrscheinlichkeitsrechnung und Statistik, Hanser 2009
- Teschl und Teschl, „Mathematik für Informatiker Band 2“, Springer 2007
- Weitz, "Konkrete Mathematik (nicht nur) für Informatiker", Springer 2018

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Bachelor Thesis		
Person responsible for the module	Faculty	
Vorsitzender der Prüfungskommission	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
7.	3.	mandatory	15

Mandatory requirements
Successful passing of all exams of the 1st stage of studies, At least 110 credit points from the 1st + 2nd stage of studies, Successful completion of the practical semester.
Recommended previous knowledge
All modules of the 1st and 2nd stage of studies

Content
see next page

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Bachelor seminar	2 SWS	3
2.	Bachelor Thesis		12



Submodule		Submodule abbreviation	
Bachelor seminar		BS	
Responsible person		Faculty	
Prof. Dr. Frank Herrmann		Computer Science and Mathematics	
Lecturer		Availability of module	
alle Professoren/innen der Fakultät IM		only in winter semester	
Teaching method			
Seminar			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
7.	2 SWS	english	3

#### Study hours required

Hours in attendance/lectures	Hours for self-study
30h	60h

Method of assessment
<p>Successfully complete a presentation, admission requirement: registration of own bachelor thesis</p> <p>Participation in 9 further seminar presentations: Participation possible with entry into the 3rd stage of studies, registration of one's own Bachelor thesis is not required.</p>

Content
subject-specific theme
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• present subject-specific results of own work in oral and written form (2)</li> <li>• discuss questions and solutions in a team (3)</li> </ul>
Teaching media
Blackboard, notebook, beamer and other media if necessary
Literature
More information about the course
Recommended prerequisites: All modules of the 1st and 2nd study section

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Submodule		Submodule abbreviation	
Bachelor Thesis		BA	
Responsible person		Faculty	
Vorsitzender der Prüfungskommission		Computer Science and Mathematics	
Lecturer		Availability of module	
alle Professoren/innen der Fakultät IM		only in winter semester	
Teaching method			
Working independently on a problem, preparing a written paper, preparing a presentation			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
7.		english	12

Study hours required

Hours in attendance/lectures	Hours for self-study
	360h

Method of assessment
Written elaboration

Content
Subject-specific theme
Learning objectives: Subject competence
After successful completion of the submodule, students are able to, apply the competences acquired during their studies to a complex subject-related problem in an interdisciplinary manner (2) and systematically expand them (3). They can efficiently research, evaluate and correctly cite scientific sources (2). They can derive a technical task from the developed state of the art and process it using scientifically validated methods (3).
Learning objectives: Personal competence
After successful completion of the submodule, students are able to, independently subdivide the processing of a complex task into work packages, plan their processing, continuously track the work status and complete it on time (2). They can present technical content in a linguistically appropriate, concise and precise manner and clearly distinguish their own results from the state of the art (2). They are able to compare alternative solutions and weigh them up in a well-founded manner (3).
Teaching media
Paper, CD/DVD, PDF file, etc.
Literature

**More information about the course**

Recommended prerequisites: All modules of the 1st and 2nd study section

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Core Module 1		
Person responsible for the module	Faculty	
Dekan Fakultät IM	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
6.	3.	mandatory	

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Scientific Seminar	4 SWS	5

Submodule		Submodule abbreviation	
Scientific Seminar		WIS	
Responsible person	Faculty		
Prof. Dr. Sebastian Fischer	Computer Science and Mathematics		
Lecturer	Availability of module		
N.N.	only in summer semester		
Teaching method			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
6.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Project report

Content
<p>This module introduces students to science communication. The following contents are taught and applied by means of a student research project from a chosen field:</p> <ul style="list-style-type: none"> <li>- Introduction to the scientific method</li> <li>- Structure of a scientific paper</li> <li>- Writing style of scientific texts</li> <li>- Formal design of a scientific paper</li> <li>- Working with scientific literature</li> <li>- Scientific preparation of technical knowledge</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• state the main criteria of scientific writing (1).</li> <li>• identify scientific literature (3).</li> <li>• use tools for literature research (3).</li> <li>• apply rules of correct citation (3).</li> <li>• develop an outline for a scientific research paper (3).</li> <li>• write a scientific text in a formally correct way (3).</li> <li>• to work independently on a scientific topic (3).</li> <li>• critically evaluate scientific literature (3).</li> </ul>

<b>Learning objectives: Personal competence</b>
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"><li>• to work on problems adequately and in a target-group-oriented manner (2).</li><li>• to independently develop a written result in a methodically sound manner within an agreed period of time (3).</li><li>• work on complex technical topics (3).</li></ul>
<b>Teaching media</b>
The media and content of the presentation and the exercises offered are discussed and prepared in the team under the guidance of the lecturer.
<b>Literature</b>
Current literature from the chosen subject area

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Core Module 2		
Person responsible for the module	Faculty	
Dekan Fakultät IM	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
6.	3.	mandatory	5

Mandatory requirements
Successful completion of all examinations of the 1st study section, At least 110 credit points from the 1st + 2nd study section
Recommended previous knowledge
depending on the respective course

Content
depending on the respective course. The courses offered are governed by the curriculum

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	International Software Development	4 SWS	5

Submodule		Submodule abbreviation	
International Software Development		SW	
Responsible person		Faculty	
Prof. Felix Schwägerl		Computer Science and Mathematics	
Lecturer		Availability of module	
Prof. Felix Schwägerl		**every second semester	
Teaching method			
Project (4 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
6./7.	4 SWS	english	5

Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Individual project presentation: 20 minutes

Content
<ul style="list-style-type: none"> <li>• Analysis, design, implementation, and test-deployment of a software project in an international team (in cooperation with partner universities of OTH Regensburg, if applicable)</li> <li>• Confrontation with socio-technical challenges such as cultural differences, time-zone discrepancy, remote collaboration</li> <li>• Practice of agile software development in different roles</li> <li>• Usage of novel support technologies facilitating software development and management (e.g., artificial intelligence, augmented reality)</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• Explain the specifics of the software engineering technologies employed in the project, both for development and for team management (1).</li> <li>• Repeat and reapply the software engineering activities conducted in the project using the same or similar technologies in real-world international software projects (2).</li> <li>• Evaluate the requirements to a given software project, design and implement parts of the solution using adequate technologies and present the solution (3).</li> <li>• Resolve and apply the specific challenges, methods, and tools occurring in international, intercultural, and geographically dispersed software engineering teams (3).</li> </ul>



<b>Learning objectives: Personal competence</b>
After successful completion of the submodule, students are able to, <ul style="list-style-type: none"><li>• Reproduce (1) and describe by own experience (2) the socio-technical challenges occurring in international software development teams.</li><li>• Work productively as part of an international software development team, adopting different roles across the software engineering lifecycle (2).</li><li>• Participate in and contribute to the improvement of the existing planning, design, and quality assurance processes (3).</li></ul>
<b>Teaching materials offered</b>
Requirements specification, project templates, technical documentatio
<b>Teaching media</b>
Laptop, beamer, blackboard
<b>Literature</b>
<ul style="list-style-type: none"><li>• Shannon Arndt: Intercultural Communication, Open Educational Resources Collection, 2020</li><li>• Ian Sommerville: Engineering Software Products, Pearson, 2021</li><li>• James D. Herbsleb: Global software engineering in the age of GitHub and Zoom. J. Softw. Evol. Process. 35(6), 2023 [and previous work referenced by the author]</li><li>• On-line documentation of selected frameworks and tools</li></ul>
<b>More information about the course</b>
Recommended prerequisites: Programming 1, Programming 2, Databases, Software Engineering esp. UML analysis and design methods.

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Core Module 3		
Person responsible for the module	Faculty	
Dekan Fakultät IM	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
6.	3.	mandatory	5

Mandatory requirements
Successful passing of all examinations of the 1st study section, At least 110 credit points from the 1st and 2nd study stage
Recommended previous knowledge
Depending on the respective course

Content
depending on the respective course The courses offered are governed by the curriculum

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Information Security	4 SWS	5

Submodule		Submodule abbreviation	
Information Security		IS	
Responsible person		Faculty	
Prof. Dr. Sebastian Fischer		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
Seminar-based teaching with exercises			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
6.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Written exam

Content
<ul style="list-style-type: none"> <li>• Introduction and topic classification</li> <li>• Protection goals</li> <li>• Classic vulnerabilities</li> <li>• Protective mechanisms</li> <li>• Organisational models</li> <li>• Technical aspects and solutions</li> <li>• Trends and developments</li> <li>• Practical exercises</li> </ul>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• understand theoretical basics and technical measures of information security and apply them to specific situations (3)</li> <li>• analyse security aspects and vulnerabilities (3)</li> <li>• weigh up security levels in a risk-oriented manner (3)</li> <li>• design and implement security solutions (3)</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>• analyse technical concepts in depth (3)</li> <li>• solve selected technical problems in group work (3)</li> <li>• communicate in teams and present their own results (3)</li> </ul>

<ul style="list-style-type: none"><li>• acquire in-depth technical knowledge through private study (3)</li></ul>
<b>Teaching media</b>
Blackboard, notebook, projector, group work in computer lab
<b>Literature</b>
<ul style="list-style-type: none"><li>• lecture slides</li><li>• Eckert C: IT-Sicherheit: Konzepte - Verfahren - Protokolle, Oldenburg Verlag (German book)</li><li>• Pieprzyk, J. et al: Fundamentals of computer security, 2010, Springer</li></ul>
<b>More information about the course</b>
Recommended prerequisites: Communication Systems and Computer Systems

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Core Module 4		
Person responsible for the module	Faculty	
Dekan Fakultät IM	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
6.	3.	mandatory	5

Mandatory requirements
Successful passing of all examinations of the 1st study section, At least 110 credit points from the 1st and 2nd study stage
Recommended previous knowledge
Depending on the respective course

Content
depending on the respective course The courses offered are governed by the curriculum

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
1.	Big Data Technology	4 SWS	5

Submodule		Submodule abbreviation	
Big Data Technology		DW	
Responsible person		Faculty	
Prof. Dr. Johannes Schildgen		Computer Science and Mathematics	
Lecturer		Availability of module	
N.N.		only in summer semester	
Teaching method			
Seminar-based teaching (2 SWS) with exercises (2 SWS)			

Semester taught according to the curriculum	Teaching hours	Teaching language	Credit value
6.	4 SWS	english	5

#### Study hours required

Hours in attendance/lectures	Hours for self-study
60h	90h

Method of assessment
Written examination and/or seminar paper and/or oral examination

Content
<p>This course teaches the fundamentals of data warehousing. This includes:</p> <ul style="list-style-type: none"> <li>• Fundamentals of Data Warehouses</li> <li>• Data-Warehousing Architecture</li> <li>• Multi-dimensional Data Modelling, Star/Snowflake-Schema</li> <li>• ETL Process, Data Cleaning, Data Integration</li> <li>• Data Analytics</li> <li>• Advanced SQL: Grouping Sets, Window Functions, Skyline Queries</li> </ul> <p>The theoretical basics taught are directly practised with modern databases.</p>
Learning objectives: Subject competence
<p>After successful completion of the submodule, students are able to,</p> <ul style="list-style-type: none"> <li>- describe the internal structure of a data warehouse, the associated OLAP process and the necessary loading processes from production operations (1),</li> <li>- create smaller data warehouse systems, initiate ETL processes and perform OLAP queries (2),</li> <li>- operate larger data warehouse systems, solve performance problems, control complex ETL processes and design elaborate OLAP queries and interpret their results correctly (3).</li> </ul>
Learning objectives: Personal competence
<p>After successful completion of the submodule, students are able to,</p>

- Understand and operate complex data warehouse systems, conduct extensive analyses of their own independently, and present the insights from data to others (3)

#### Teaching materials offered

Lecture notes  
PowerPoint presentation  
All programmes used in the course

#### Teaching media

Blackboard, projector with notebook

#### Literature

- Köppen/Sattler/Saake: Data Warehouse Technologies, 2014
- Bauer/Günzel: Data Warehouse Systems, dpunkt, 2013
- Mehrwald: Datawarehousing with SAP BW 7.3, dpunkt, 2013
- Kimball/Ross: Kimball's Data Warehouse Toolkit, Wiley&Sons, 2009
- Kemper/Baars/Mehanna: Business Intelligence, Springer, 2010
- Jockisch: Data Warehouse and SAP Business Information Warehouse, Script OTH Regensburg
- Kurz: Data Warehousing, mitp, 1999

#### More information about the course

Recommended prerequisites: Extensive knowledge of databases

The numbers in brackets indicate the levels to be reached: 1 - understanding 2 - ability 3 - understand and application

Module title		Module code
Mandatory Subject-Specific Elective Module 1		
Person responsible for the module	Faculty	
N.N.	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
6.	3.	mandatory elective	5

Mandatory requirements
At least 30 credits from the 1st study stage
Recommended previous knowledge
Modules of the 1st and partly of the 2nd study stage depending on the chosen course

Content
Depending on the respective course Scope of teaching 4 SWS

Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
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Notes on the assignment requirement or options
<p>The courses offered for the subject-specific compulsory elective modules (FWPM) are regulated by the semester-specific study plan. The module descriptions for the semester-specific subject-related compulsory elective modules offered by the faculty can be found in the "Overview of module descriptions for subject-related compulsory elective modules - current semester offer" on the homepage of the faculty for each degree programme under the heading "Modules and subject descriptions". The module offers for the respective semester are marked with the corresponding degree programme and study section assignment. The assignment criteria of the courses to the degree programmes and study sections must be strictly adhered to:</p> <p>Notes on study section assignment:  Z + module abbreviation: Second stage of studies  D + module abbreviation: Third stage of studies  K + module abbreviation: Second and third stage of studies</p>



Module title		Module code
Mandatory Subject-Specific Elective Module 2		
Person responsible for the module	Faculty	
Dekan Fakultät IM	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
6.	3.	mandatory elective	5

Mandatory requirements
Successful completion of all examinations of the 1st study stage, at least 110 credit points from the 1st + 2nd study stage.
Recommended previous knowledge
Modules of the 1st and 2nd stage of studies depending on the chosen course

Content
depending on the respective course

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
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Notes on the assignment requirement or options
<p>The courses offered for the subject-specific compulsory elective modules (FWPM) are regulated by the semester-specific study plan. The module descriptions for the semester-specific subject-related compulsory elective modules offered by the faculty can be found in the "Overview of module descriptions for subject-related compulsory elective modules - current semester offer" on the homepage of the faculty for each degree programme under the heading "Modules and subject descriptions". The module offers for the respective semester are marked with the corresponding degree programme and study section assignment. The assignment criteria of the courses to the degree programmes and study sections must be strictly adhered to:</p> <p>Notes on study section assignment:  Z + module abbreviation: Second stage of studies  D + module abbreviation: Third stage of studies  K + module abbreviation: Second and third stage of studies</p>

Module title		Module code
Mandatory Subject-Specific Elective Module 3		
Person responsible for the module	Faculty	
Dekan Fakultät IM	Computer Science and Mathematics	

Semester taught according to the curriculum	Level of study	Module type	Credit value
7.	3.	mandatory elective	5

Mandatory requirements
Successful completion of all examinations of the 1st study section, At least 110 credit points from the 1st + 2nd study section
Recommended previous knowledge
Modules of the 1st and 2nd stage of studies depending on the chosen course

Content
depending on the respective course

#### Assigned submodules

Nr.	Submodule title	Teaching hours	Credit value
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Notes on the assignment requirement or options
<p>The courses offered for the subject-specific compulsory elective modules (FWPM) are regulated by the semester-specific study plan. The module descriptions for the semester-specific subject-related compulsory elective modules offered by the faculty can be found in the "Overview of module descriptions for subject-related compulsory elective modules - current semester offer" on the homepage of the faculty for each degree programme under the heading "Modules and subject descriptions". The module offers for the respective semester are marked with the corresponding degree programme and study section assignment. The assignment criteria of the courses to the degree programmes and study sections must be strictly adhered to:</p> <p>Notes on study section assignment:  Z + module abbreviation: Second stage of studies  D + module abbreviation: Third stage of studies  K + module abbreviation: Second and third stage of studies</p>