Course Handbook Technical Computer Science Bachelor

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Head of Studies	Prof. Dr. Peter Birkner
Deputy Head of Studies	Prof. Dr. Markus Esch
Chairman of Examination	Prof. Dr. Klaus Berberich
Deputy Chairman of Examination	Prof. Dr.-Ing. Martin Burger

Qualifikation Goals of Study Programme

Technical Computer Science Bachelor - mandatory courses (overview)

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Databases	TIB-DB		3	3V+1P	5	Prof. Dr. Klaus Berberich
Introduction to Communications Engineering	TIB-NRTG		2	4V+2P	5	Prof. Dr. Albrecht Kunz
Mathematics 1	TIB-MAT1		1	4V+2U	7	Prof. Dr. Peter Birkner
Mathematics 2	TIB-MAT2		2	3V+1U	5	Prof. Dr. Peter Birkner
Microprocessor Technology	TIB-MP		5	2V+2P	5	Prof. Dr.-Ing. Jürgen Schäfer
Project Management	TIB-PM		2	2V	3	Prof. Dr. Steffen Knapp
Project work	TIB-PA		5	3PA+1S	6	Professor/innen des Studiengangs
Scientific Work	TIB-WA		4	1V+1U	2	Prof. Dr. Peter Birkner
Security Engineering	TIB-SE		4	2V+2P	5	Prof. Dr. Damian Weber

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Technical Reading and Writing	TIB-TRW		1	2S	2	Dipl.-Übers. Betina Lang
Theoretical Informatics	TIB-TI		5	4V	5	Prof. Dr. Maximilian Altmeyer

(11 modules)

Technical Computer Science Bachelor - optional courses (overview)

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
.NET Concepts and Tools	TIB-NETW		6	2V+2P	5	Thomas Beckert, M.Sc.
"Engineering Visions" Intensive Program	TIB-IPRE		4	3PA+1S	4	Prof. Dr. Martin Löffler-Mang
Applied Computer Science Seminar	TIB-SAI		5	2S	3	Prof. Dr.-Ing. André Miede
Automated Software Development	TIB-ASE		4	2V+2PA	5	Prof. Dr.-Ing. Martin Burger
Automotive Engineering	TIB-ATEC		6	2V	3	Prof. Dr. Horst Wieker
Basic Principles Governing the Qualification of Trainers and Instructors in Germany's Dual Education and Vocational Training System	TIB-AUSB		6	2V	2	Studiendekan
	TIB-BCI		-	1V+3PA	6	

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Brain-Computer Interface						Prof. Dr. Dr. Daniel Strauß
Broadband Technology and its Applications	TIB-BBTA		6	2V	3	Prof. Dr. Horst Wieker
CAX Basics and Applications	TIB-CAX		3	2V+2U	5	Prof. Dr.-Ing. Pascal Stoffels
Cloud Computing	TIB-CCOM		6	2V+2PA	5	Prof. Dr. Markus Esch
Compiler Construction	TIB-CBAU		5	2V+2P	5	Prof. Dr. Markus Esch
Computer Science and Society Seminar	TIB-SCSS		6	2S	3	Prof. Dr.-Ing. André Miede
Computer Science in the Media	TIB-SIDM		6	2S	3	Prof. Dr. Klaus Berberich
Computer Vision	TIB-CVIS		6	4V	5	Prof. Dr. Gerald Kroisandt
Design Patterns	TIB-EWM		6	4V	3	Prof. Dr.-Ing. Martin Burger
Digital Production Systems	TIB-DPS		4	2V+2S	5	Prof. Dr.-Ing. Pascal Stoffels
Digital Signal Processing	TIB-DSIG		5	2V+2P	4	Prof. Dr. Martin Buchholz
Digital Television Technology	TIB-DIGF		6	2V	3	Prof. Dr. Martin Buchholz
Electromobility	TIB-EMOB		6	2V	3	Prof. Dr. Horst Wieker
Embedded Linux	TIB-EMBL		6	2V+2P	4	Dipl.-Inf. Ulrich Bruch

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Enterprise Java Beans	TIB-EJB		6	2V+2P	5	Prof. Dr.-Ing. Martin Burger
Error-Identification and Error-Correcting Codes	TIB-FFKC		5	2V	3	Dipl.-Math. Wolfgang Braun
French for Beginners I	TIB-FFA1		5	2SU	2	Dr. Julia Frisch
French for Beginners II	TIB-FFA2		6	2SU	2	Dr. Julia Frisch
French I	TIB-FRA1		5	2SU	2	Dr. Julia Frisch
French II	TIB-FRA2		6	2SU	2	Dr. Julia Frisch
Functional Programming	TIB-FPRG		6	2V+2P	5	Prof. Dr. Thomas Kretschmer
Future Internet and Smart City with Software Defined Networking	TIB-FISC		5	4V	5	Prof. Joberto Martins
Future Internet: Software Defined Networking	TIB-FSDN		5	4V	4	Prof. Dr. Damian Weber
Game Design	TIB-GAD		5	4V	5	Prof. Dr. Maximilian Altmeyer
Game Design and Development	TIB-GDEV		-	2V+2P	5	Prof. Dr.-Ing. André Miede
GUI Programming with Qt	TIB-PRQT		-	4V	5	Hong-Phuc Bui, M.Sc.
Human Computer Interaction	TIB-HCI		5	4V	5	Prof. Steven Frysinger
Industrial Development	TIB-IEP		4	3V+1U	5	Prof. Dr. Kai Haake

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Processes						
Industrial Ecology	TIB-INEC		6	4V	5	Prof. Steven Frysinger
Information Retrieval	TIB-IRET		5	2V+2PA	5	Prof. Dr. Klaus Berberich
Information Security	TIB-ISEC		5	2V	3	Prof. Dr. Damian Weber
Intercultural Communication	TIB-INTK		6	2SU	2	Dr. Julia Frisch
Internet and the Law	TIB-REII		5	2V	2	RA Cordula Hildebrandt
Introduction to Astronomy	TIB-ASTR		5	2V	2	Prof. Dr. Martin Löffler-Mang
Introduction to Parallel Programming with CUDA	TIB-CUDA		5	1V+1P	3	Dipl.-Inform. Marion Bohr
Introduction to the Basics of Artificial Intelligence	TIB-GKI		5	2V+2S	5	Prof. Dr. Christoph Tholen
Introduction to Wireless LANs	TIB-WLAN		6	2V	3	Dipl.-Math. Wolfgang Braun
IT Forensics	TIB-ITF		5	1V+1P	2	Prof. Dr. Damian Weber
IT Forensics Practical Course	TIB-ITFP		6	2P	3	Prof. Dr. Damian Weber
IT Security Project	TIB-PITS		5	4PA	5	Prof. Dr. Damian Weber
Kinematic Principles of Robotics	TIB-KGR		5	3V+1U	5	Prof. Dr. Michael Kleer
	TIB-REXG		6	2V	2	

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Law for Business Founders						RA Cordula Hildebrandt
Machine Learning	TIB-MLRN		6	2V+2U	5	Prof. Dr. Klaus Berberich
Mathematical Software Systems and Algorithmic Applications	TIB-MSAA		5	4V	5	Prof. Dr. Barbara Grabowski
Measurements and Simulations in Communications Engineering	TIB-MSNT		6	2V+2P	5	Prof. Dr. Albrecht Kunz
Mentoring	TIB-MENT		5	2S	2	Sandra Wiegand, M.A.
Methods and Applications from the Field of Artificial Intelligence for Signal and Image Processing	TIB-KISB		-	4PA	5	Prof. Dr.-Ing. Ahmad Osman
Mobile Application Development (Android)	TIB-MADA		5	2V+2P	5	Christoph Karls, M.Sc.
Numerical Software	TIB-NUMS		-	2V+2PA	5	Prof. Dr. Gerald Kroisandt
Oral Presentation Skills	TIB-RP		-	2S	2	Studienleitung
Preparing for the IELTS Test	TIB-IEL		6	2VU	2	Dr. Julia Frisch
Presenting a Project	TIB-SSP		6	2V	2	Dr. Julia Frisch
Principles of Web Development	TIB-WEB		5	2V+2U	5	Prof. Dr. Maximilian Altmeyer

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Programming Tools	TIB-PRGW		6	2V+2P	5	Prof. Dr. Reinhard Brocks
Risk-Based Decision Making and Statistical Data Analysis	TIB-ERSD		5	2V+2P	4	Melanie Kaspar, M.Sc.
Robotics Lab Course	TIB-ROBP		6	2P	4	Dipl.-Ing. Dirk Ammon
Ruby on Rails	TIB-RUBY		6	3V+1P	4	Dipl.-Inf. Julian Fischer
Running RoboNight Workshops	TIB-ROBO		6	1PA+1S	3	Prof. Dr. Steffen Knapp
Russian for Beginners 1	TIB-RFA1		6	2SU	2	Dr. Julia Frisch
Russian for Beginners 2	TIB-RFA2		6	2SU	2	Dr. Julia Frisch
Semiconductor Technology and Production	TIB-HLTP		6	4V	5	Prof. Dr. Albrecht Kunz
Sino-German Student Club for Smart Sensors	TIB-SGSC		6	1V+3PA	5	Prof. Dr. Martina Lehser
Software Development for Collaborative Industrial Robots	TIB-IROB		5	4PA	5	Prof. Dr. Steffen Knapp
Software Development with Jakarta EE	TIB-SEJ		5	2V+2PA	5	Prof. Dr. Markus Esch
Spanish for Beginners I	TIB-SFA1		5	2SU	2	Dr. Julia Frisch
Spanish for Beginners II	TIB-SFA2		6	2SU	2	Dr. Julia Frisch
Sustainable Product Engineering	TIB-SPE		4	2V+2U	5	Prof. Dr.-Ing. Pascal Stoffels

Module name (EN)	Code	SAP-P	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Systems Engineering	TIB-SYSE		5	2V+2PA	5	Prof. Dr. Martin Buchholz
Technical Documentation	TIB-TDOK		6	2V	2	Dipl.-Ing. Irmgard Köhler-Uhl
The Impact of Gender and Diversity on Careers and Studies	TIB-GD		-	2V+2S	5	Sandra Wiegand, M.A.
The Impact of Gender and Diversity on Careers and Studies (Submodule)	TIB-GDT		-	-	3	Sandra Wiegand, M.A.
User Experience Engineering	TIB-UXE		4	2V+2U	5	Prof. Dr. Maximilian Altmeyer
Web Security Project	TIB-PWS		6	1V+1PA	3	Prof. Dr. Damian Weber

(79 modules)

Technical Computer Science Bachelor - mandatory courses

Databases

Module name (EN): Databases
Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026
Module code: TIB-DB
Hours per semester week / Teaching method: 3V+1P (4 hours per week)
ECTS credits: 5
Semester: 3

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam, Duration 120 min.

[*updated 13.10.2024*]

Applicability / Curricular relevance:

DFBI-323 (P610-0219) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018 , semester 3, mandatory course
DFIW-DB (P610-0183) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 3, mandatory course
KIB-DB (P222-0009) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 3, mandatory course
KIB-DB (P222-0009) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course
PIB-DB (P221-0018) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course
PIB-DB (P221-0018) Applied Informatics, Bachelor, SO 01.10.2026 , semester 3, mandatory course
PRI-DB (P222-0009) Production Informatics, Bachelor, SO 01.10.2023 , semester 3, mandatory course
PRI-DB (P222-0009) Production Informatics, Bachelor, SO 01.10.2026 , semester 3, mandatory course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Klaus Berberich

Lecturer: Prof. Dr. Klaus Berberich

[*updated 24.11.2025*]

Learning outcomes:
After successfully completing this module, students will be able to use relational database systems in practice. To do so, they will learn data modelling techniques and be able to apply them to problems in real life. Students will understand the relational model and relational algebra as the mathematical foundations of relational database systems. They will be capable of deriving a relational schema from a modelled section from the real world. Students will be able to assess its quality on the basis of relational normal forms (1NF, 2NF, 3NF) and improve it if necessary by converting it into a higher normal form. They will also be able to formulate concrete information requirements as expressions of relational algebra. Students will be familiar with the essential commands of the Structured Query Language (SQL) and can use them to change the schema of a database and the data stored in it. In addition, they will also be able to express a given need for information as a query in SQL and to understand and communicate a given SQL query. Students will understand the central concept of the transaction and can define each of the ACID properties and illustrate

them with examples. They will be able to name different types of indexes in relational database systems and can use them depending on the situation. In order to solve more complex problems with the help of a relational database system, students will be familiar with the basic language components of procedural extensions (e. g. Oracle PL/SQL and Microsoft TransactSQL) of SQL. In addition, students will be familiar with interfaces (e. g. ODBC and JDBC) for accessing a relational database system from an application. They will be capable of accessing an existing relational database from a programming language known to them (e. g. Java, Python or C) by means of these interfaces. Finally, students will know alternatives to relational databases (e. g. document-oriented databases and graph databases) and can name differences.

[*updated 13.10.2024*]

Module content:
1. Introduction
2. Database design
3. Relational model and relational algebra
4. Structured Query Language (SQL)
5. Relational design theory
6. Data integrity
7. Transaction management
8. Database tuning
9. Security aspects
10. Programming with SQL
11. Database interfaces
12. Non-relational databases

[*updated 13.10.2024*]

Teaching methods/Media:
Transparencies, script, example databases in SQLite, practical and theoretical exercises.

[*updated 13.10.2024*]

Recommended or required reading:
Kemper Alfons und Eickler André: Datenbanksysteme - Eine Einführung, De Gruyter, 2015

Saake Gunter und Sattler Kai-Uwe: Datenbanken - Konzepte und Sprachen, mitp Professional, 2018

Wiese Lena: Advanced Data Management, De Gruyter, 2015

[*updated 13.10.2024*]

Introduction to Communications Engineering

Module name (EN): Introduction to Communications Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-NRTG

Hours per semester week / Teaching method:
4V+2P (6 hours per week)

ECTS credits:

5

Semester: 2

Mandatory course: yes

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

KIB-NRTG (P222-0022) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 2, mandatory course
KIB-NRTG (P222-0022) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 2, mandatory course

Workload:
90 class hours (= 67.5 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 82.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Albrecht Kunz

Lecturer:
Dipl.-Ing. Harald Krauss

[*updated 12.01.2026*]

Learning outcomes:
After successfully completing this course, students will have obtained sound basic knowledge and system expertise in the field of communication technologies. Students will acquire the skills needed to implement software for use in communication systems based on the basic principles of communications engineering.

They will become familiar with the concepts and systems of communications engineering, enabling them to work independently with new future standards. This will become more and more important in the course of their professional lives and aid them in driving innovative developments in the diverse fields of communications technology and embedded systems, for example.

Through hands-on work in the practical part of the course, students will learn to apply the knowledge they have acquired in the lecture to concrete tasks, visualize it with simulation tools and then present their work results. In this way, several core competencies are acquired: visualization and the successful presentation of

scientific and technical content, as well as the mastery of simulation tools.

By simulating, preparing and presenting their simulation results together in small groups, students will also learn how to work in groups (team skills).

[*updated 19.02.2018*]

Module content:

1. Reference and architectural models in communications engineering
1.1 OSI reference model for telecommunication
1.2 Layers of the OSI model, interaction with adjacent layers

2. Basics of the signal theory, the information theory and signal processing
2.1 Signal properties
2.2 Time and frequency domain signal display, bandwidth
2.3 Complex signal display
2.4 Linear filters
2.5 Filter coefficients, impulse response, amplitudes and phase response
2.6 Digitalization of analog signals, sampling theorem, AD/DA conversion
2.7 Periodic signals (Fourier series development, spectral representation)

3. Introduction to electronics and semiconductor technology
3.1 Materials for the semiconductor industry
3.2 P- and n-doping, p-n junction
3.3 Diodes, mode of operation and characteristic curve, designs, operating point
3.4 Circuits with diodes (rectifier circuits, voltage stabilization, etc.)
3.5 Transistors, characteristics, transistor parameters, connection / operation, characteristic curve fields
3.6 Transistor amplifier circuits, characteristics (current and voltage amplification, bandwidth, etc.)
3.7 Electronic oscillators

4. Basic concepts of radio technology
4.1 Signal damping
4.2 Signal and noise power, signal-to-noise ratio (SNR)
4.3 Signal level, level calculation in dB
4.4 Principles of antenna technology, characteristics of antennas, radiation diagrams
4.5 Frequency bands, transmission paths (long/medium/shortwave, mobile and satellite radio)

5. Wired communication
5.1 Telegraph equations, transmission line theory, wave impedance
5.2 Standing waves on transmission lines, reflection and adaptation coefficient
5.3 Crosstalk on electrical cables

6. Modulation methods
6.1 Amplitude modulation
6.2 Digital modulation

7. Digital baseband transmission
7.1 Model of the digital transmission path
7.2 Transmission channel, noise interference (AWGN)
7.3 Detection, error probability, bit error rate (BER)

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture: Board, projector, flipchart, demonstrations with mobile measuring equipment

Seminar: The seminar is accompanied by a lecture and supplemented by simulations on selected topics of the lecture. Under the guidance of a lecturer, students will independently carry out simulations in small groups using professional simulation tools (e. g. Mathworks MATLAB, Orcad PSPICE, etc.).

The simulation results will be prepared jointly by the student groups and then presented in the seminar for their fellow students.

[*updated 19.02.2018*]

Recommended or required reading:
Martin Werner: Nachrichtentechnik: Eine Einführung für alle Studiengänge, Vieweg Teubner
Eberhard Herter, Wolfgang Lörcher: Nachrichtentechnik, Hanser
Martin Meyer: Kommunikationstechnik, Springer Vieweg
Rudolf Mäusl, Jürgen Göbel: Analoge und digitale Modulationsverfahren. Basisband und Trägermodulation, Hüthig
Martin Werner: Digitale Signalverarbeitung mit MATLAB, Vieweg Teubner
Ulrich Stein: Programieren mit MATLAB, Hanser
Robert Heinemann: PSPICE Einführung in die Elektroniksimulation, Hanser
Holger Göbel: Einführung in die Halbleiter-Schaltungstechnik, Springer Vieweg
Alois Krischke: Rothammels Antennenbuch, DARC

[*updated 19.02.2018*]

Mathematics 1

Module name (EN): Mathematics 1

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MAT1

Hours per semester week / Teaching method:
4V+2U (6 hours per week)

ECTS credits:
7

Semester: 1

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KIB-MAT1 (P221-0001) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 1, mandatory course
KIB-MAT1 (P221-0001) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 1, mandatory course
PIB-MA1 (P221-0001) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 1, mandatory course
PIB-MA1 (P221-0001) Applied Informatics, Bachelor, SO 01.10.2026 , semester 1, mandatory course
PRI-MAT1 (P221-0001) Production Informatics, Bachelor, SO 01.10.2023 , semester 1, mandatory course
PRI-MAT1 (P221-0001) Production Informatics, Bachelor, SO 01.10.2026 , semester 1, mandatory course

Workload:
90 class hours (= 67.5 clock hours) over a 15-week period.
The total student study time is 210 hours (equivalent to 7 ECTS credits).
There are therefore 142.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Peter Birkner

Lecturer: Prof. Dr. Peter Birkner

[*updated 24.11.2025*]

Learning outcomes:
Students will learn basic mathematical concepts from the areas of predictive logic, sets and figures and be able to use them confidently when formulating mathematical statements.
Students will be able to reproduce basic formulas from the field of combinatorics and use these to develop solutions for combinatoric problems.
They will be capable of explaining the mathematical proof concepts of direct proof, indirect proof and complete induction and thus, come up with new evidence.
They will be able to enumerate the axioms of the algebraic structures group, ring and field and check the corresponding properties for structures with given operations.
Students will learn the terms and statements of group theory and be able to identify them in examples of groups, such as (Z/mZ, +) and ((Z/pZ)\{0}, *).
They will be able to explain vector space axioms and demonstrate them in Euclidean space.
Students will be able to develop solutions in Euclidean space for geometrical problems using vector algebra, the dot product, the vector product and the triple product.
They will be able to explain basic concepts of the theory of n-dimensional vector spaces.
They will have mastered elementary matrix calculation rules and determinant calculation rules and learn how linear images can be represented and handled using matrices.
Students will be able to demonstrate how to solve a linear system and learn to master the Gauss algorithm as a method for solving linear systems.
Finally, students will gain an insight into the manifold applications of mathematics in computer science (the development of programming languages,

program verification, digital technology, computing accuracy on computers, cryptography, computer graphics_).

[*updated 19.02.2018*]

Module content:
Basic mathematical terms
Propositional logic, first-order logic, sets, especially uncountably infinite sets
Relations, especially equivalence relations, partitions, functions
Algebraic structures
Semigroups, monoids
Groups, subgroups, normal subgroups, quotient groups, homomorphisms
Rings, fields, in particular Z/mZ
Natural numbers, mathematical induction, recursion
Peano axioms
Mathematical induction
Recursive definitions
Binominal coefficients and binomial formulae
Basic concepts of combinatorics (with quantitative considerations)
Elementary vector calculation in Euclidean space
Vector algebra, linear independence, dimension
Vectors in coordinate systems, dot product, vector product, triple product
Geometric applications
Vectors in n-dimensional space
Generating sets, basis, subspaces
Linear functions, image space, core
Representation of linear functions with matrices
Geometric applications: projections, reflections, rotations
Matrices and linear systems
Linear systems, Gaussian elimination
Square matrices, matrix inversion, determinants, Cramer´s rule

[*updated 26.02.2018*]

Teaching methods/Media:
Lecture. An exercise sheet will be distributed every week and then discussed in small groups the following week. In addition, a tutorial will be available for work in small groups. This is voluntary. In the tutorials, students will be able work on exercises themselves (with support from the tutor, if necessary) and ask questions about the lecture material. The tutorial can also be used to fill knowledge gaps.

[*updated 26.02.2018*]

Recommended or required reading:
- P. Hartmann, Mathematik für Informatiker (Vieweg); can be downloaded via OPAC as a PDF.
- M. Brill, Mathematik für Informatiker (Hanser).

[*updated 26.02.2018*]

Mathematics 2

Module name (EN): Mathematics 2

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MAT2

Hours per semester week / Teaching method:
3V+1U (4 hours per week)

ECTS credits:
5

Semester: 2

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KIB-MAT2 (P221-0002) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 2, mandatory course
KIB-MAT2 (P221-0002) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 2, mandatory course
PIB-MA2 (P221-0002) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 2, mandatory course
PIB-MA2 (P221-0002) Applied Informatics, Bachelor, SO 01.10.2026 , semester 2, mandatory course
PRI-MAT2 (P221-0002) Production Informatics, Bachelor, SO 01.10.2023 , semester 2, mandatory course
PRI-MAT2 (P221-0002) Production Informatics, Bachelor, SO 01.10.2026 , semester 2, mandatory course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Peter Birkner

Lecturer: Prof. Dr. Peter Birkner

[*updated 24.11.2025*]

Learning outcomes:
_ After successfully completing this module, students will be familiar with the definition of the term _limit_ for sequences and real functions and will

have learned to master the use of limit theorems.
_ They will know the convergence criteria for series and be able to handle them confidently when checking series for convergence.
_ They will be able to explain the importance of series expansion for numerical mathematics and computer science applications.
_ Students will be familiar with the properties of exponential and logarithmic functions and be able to deal with them confidently
in computer science applications.
_ They will know the definition of derivation for functions of a variable as a limit value and
will have learned to master the derivation rules for functions of a variable.
_ Students will be able to develop solutions for the application of differential calculus (setting limits with _L´Hospital´s rule, extreme value tasks, Taylor series
and error estimation).
_ They will be familiar with the definition of definite and indefinite integrals for variable functions, as well as
be able to develop integration solutions using the integration methods _partial integration_ and
integration by substitution.
_ Finally, they will have learned to master complex numbers in the usual forms for representation.

[*updated 24.02.2018*]

Module content:
Sequences and series
Supremum, infimum, limits, limit theorems
Series, direct comparison test and ratio test
Geometric series, exponential series
Continuity
Function limits
Properties of continuous functions
Inverse functions, logarithms, inverse trigonometric functions
Differential calculus
Concept of derivation, calculation rules
Properties of differentiable functions
Higher derivatives
Monotonicity and convexity
Applications such as Hospital´s rule, extreme value tasks and Taylor series
Integral calculus
Riemann sums, definite integral
Indefinite integral, fundamental theorem of calculus
Integration methods: partial integration, substitution rule
Complex numbers

[*updated 24.02.2018*]

Teaching methods/Media:
Lecture at board Every two weeks an exercise sheet will be distributed and then discussed in small groups the following week. In addition, a tutorial will be offered every two weeks for work in small groups. This is voluntary. In the tutorials, students will be able work on exercises themselves (with support from the tutor, if necessary) and ask questions about the lecture material. The tutorial can also be used to fill knowledge gaps.

[*updated 26.02.2018*]

Recommended or required reading:
- P. Hartmann, Mathematik für Informatiker (Vieweg); can be downloaded via OPAC as a PDF.
- M. Brill, Mathematik für Informatiker (Hanser).

[*updated 19.02.2018*]

Microprocessor Technology

Module name (EN): Microprocessor Technology

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MP

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam (50%), practical course (50%)

[*updated 26.02.2018*]

Applicability / Curricular relevance:

PIB-MP (P221-0028) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, mandatory course
PIB-MP (P221-0028) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Jürgen Schäfer

Lecturer: Prof. Dr.-Ing. Jürgen Schäfer

[*updated 24.11.2025*]

Learning outcomes:
After successfully completing this module, students will have understood the structure and operation of a microcontroller with peripheral components based on the example of a modern RISC architecture. Through programming exercises, they will be able to create programs in Assembler and C for selected problems.

[*updated 26.02.2018*]

Module content:

1. The architecture of ARM7
2. The ARM7 Programming Model
   - 2.1 The ARM Instruction Set
   - 2.2 Addressing modes
   - 2.2.1 Pre-indexed and post-indexed addressing
   - 2.2.2 Direct addressing
   - 2.4 Assembler directives
   - 2.4.1 Symbol definition
   - 2.4.2 Memory initialization/reservation
   - 2.4.3 Memory allocation
   - 2.5 Special operating modes
   - 2.5.1 Interrupt vectors
   - 2.5.2 System boot after reset
3. The LPC2000 Processor Family
   - 3.1 Memory partitioning
   - 3.2 Vectored interrupts
   - 3.3 Peripheral components
4. Microcontroller C-programming
   - 4.1 Procedure when starting the C application
   - 4.2 Attributes for variables
5. Digital in and output
6. Configuring port pins
7. External interrupts
8. The Vectored Interrupt Controller (VIC)
9. Timer
10. Serial data transmission

[*updated 26.02.2018*]

Recommended or required reading:
D. Seal: ARM Architecture Reference Manual, Addison-Wesley, Harlow, 2001
N.N.: Programming Techniques, Advanced RISC Machines, Cambridge , 1995
N.N.: ARM Software Development Toolkit User Guide, Advanced RISC Machines, Cambridge , 1998
T. Martin: The Insiders Guide to the Philips ARM7 Based Microcontrollers, Hitex, Coventry, 2005
N.N: User Manual LPC2119/2129/2194/2292/2294, Philips Semiconductors, 2004
J. A. Langbridge: Professional Embedded ARM Development, John Wiley & Sons, 2014

http://infocenter.arm.com/help

[*updated 26.02.2018*]

Project Management

Module name (EN): Project Management
Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026
Module code: TIB-PM
Hours per semester week / Teaching method: 2V (2 hours per week)
ECTS credits: 3
Semester: 2
Mandatory course: yes
Language of instruction: German
Assessment: Written exam [*updated 19.02.2018*]
Applicability / Curricular relevance: KI567 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical KIB-PM (P222-0032) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 2, mandatory course KIB-PM (P222-0032) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 2, mandatory course PIB-PM (P221-0036) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course PIB-PM (P221-0036) Applied Informatics, Bachelor, SO 01.10.2026 , semester 3, mandatory course PRI-PM (P222-0032) Production Informatics, Bachelor, SO 01.10.2023 , semester 2, mandatory course PRI-PM (P222-0032) Production Informatics, Bachelor, SO 01.10.2026 , semester 4, mandatory course
Workload: 30 class hours (= 22.5 clock hours) over a 15-week period. The total student study time is 90 hours (equivalent to 3 ECTS credits). There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.
Recommended prerequisites (modules): None.
Recommended as prerequisite for:
Module coordinator: Prof. Dr. Steffen Knapp

Lecturer: Prof. Dr. Steffen Knapp

[*updated 24.11.2025*]

Learning outcomes:
After successfully completing this course, students will be able to reconstruct the project planning for typical and manageable student IT projects in functional project management.

They will be capable of independently implementing an adequate form of project organization and exercising project governance during the continuous project development cycle. They will be able to recognize deviations from the plan and adjust project planning accordingly.

Students will learn to use basic project management tools, i. e. they can create work-breakdown structures, map workflows with the precedence diagram method and understand the consequences of plan changes.

They will learn to prepare and conduct meetings and to communicate their information and the results for efficient project control.

Students will become familiar with estimation processes for IT projects and know how to use them in such projects in order to stabilize project planning.

They will develop an understanding of how to work in project teams and assume project management functions.

[*updated 19.02.2018*]

Module content:
Definitions of project and project management
Projects and project management in companies
Project management tools
Special features of software projects
- Information and communication
- Cost estimation
- Collaborative software

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture, simulations and workshop
Lecture script available as a PDF download

[*updated 19.02.2018*]

Recommended or required reading:
BURGHARDT M.: Projektmanagement, Publics MCD Verlag, 2000
WESTERMANN R.: Projektmanagement mit System, Gabler Verlag, 2001
MOTZEL E.+PANNENBÄCKER O.:Projektmanagement-Kanon, Roderer Verlag, 2002 TURNER M.: Microsoft Solutions Framework Essentials; Building Successful Technology Solutions, Microsoft Press ISBN-10:0-7356-2353-8
WIECZORREK W., MERTENS P.: Management von IT-Projekten, SpringerLink Verlag ISBN-978-3-642-16126-1
BOHINC T.: Führung im Projekt, SpringerLink Verlag ISBN-978-3-642-22625-0 BERGMANN R, BARRECHT M.: Organisation und Projektmanagement, SpringerLink Verlag ISBN-978-3-7908-2017-1
KÖNIGS H.-P.: IT-Risikomanagement mit System, SpringerLink Verlag ISBN-ISBN 978-3-8348-1687-0

[*updated 19.02.2018*]

Project work

Module name (EN): Project work
Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026
Module code: TIB-PA
Hours per semester week / Teaching method: 3PA+1S (4 hours per week)
ECTS credits: 6
Semester: 5
Mandatory course: yes
Language of instruction: German
Assessment: Composition/Presentation/Seminar talk [*updated 24.02.2018*]
Applicability / Curricular relevance: PIB-PA (P221-0035) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, mandatory course PIB-PA (P221-0035) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, mandatory course Suitable for exchange students (learning agreement)
Workload: 60 class hours (= 45 clock hours) over a 15-week period. The total student study time is 180 hours (equivalent to 6 ECTS credits). There are therefore 135 hours available for class preparation and follow-up work and exam preparation.
Recommended prerequisites (modules): None.
Recommended as prerequisite for:
Module coordinator: Professor/innen des Studiengangs
Lecturer: Professor/innen des Studiengangs [*updated 24.11.2025*]

Learning outcomes:
After successfully completing this course, students will:
_ have gained the knowledge and experience necessary to conceive, plan and execute a practical project.
_ have learned the methods and procedures required for each phase of a project in medium-sized teams (6-to 10 students).
_ have gained experience in leading a team, team work and conflict management.

[*updated 24.02.2018*]

Module content:
Students will apply their knowledge from the fields of software engineering, programming and databases in an IT-related project under the supervision of lecturers from their respective subjects. The project work will integrate different methods/work techniques such as for example, project management, team work, the creation of documentation and the presentation of results. A seminar accompanies this project work course. Within the framework of the seminar, each student is required to give a lecture of at least 30 minutes on a technical or project-related topic.

[*updated 24.02.2018*]

Teaching methods/Media:
Written composition, slides, presentation

[*updated 24.02.2018*]

Recommended or required reading:
Project-related literature will be specified by the lecturer.

[*updated 24.02.2018*]

Scientific Work

Module name (EN): Scientific Work

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-WA

Hours per semester week / Teaching method:
1V+1U (2 hours per week)

ECTS credits:
2

Semester: 4

Mandatory course: yes

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

PIB-WA (P221-0046) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, mandatory course
PIB-WA (P221-0046) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, mandatory course
PRI-WA Production Informatics, Bachelor, SO 01.10.2026 , semester 4, mandatory course

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Peter Birkner

Lecturer: Prof. Dr. Peter Birkner

[*updated 24.11.2025*]

Learning outcomes:
After successfully completing this module, students will be able to describe and explain how scientific work works, especially in computer science. In doing so, they will be able to use their knowledge to carry out searches and document arguments in writing as well as with the help of quotations. In addition, students will be able to use the most common scientific documentation tools.

[*updated 24.02.2018*]

Module content:
Methodical and technical basics will first be taught and then intensified through practical exercises. Exams will be conducted parallel within the framework of the exercises, which students will work on independently.

1. Principles of science
2. Forms of science in Informatics
3. Scientific activity in Informatics
4. Research: goals, methodology, sources
5. Arguing and quoting
6. Tools for scientific documentation
7. Articulating scientific results
8. Selected special topics

[*updated 24.02.2018*]

Teaching methods/Media:
Transparencies, projector, board, discussions, theoretical and practical exercises

[*updated 24.02.2018*]

Recommended or required reading:
Martin Kornmeier: Wissenschaftlich Schreiben leicht gemacht, utb, 2013.
Marcus Deininger, Horst Lichter, Jochen Ludewig, Kurt Schneider: Studien-Arbeiten: Ein Leitfaden zur Vorbereitung, Durchführung und Betreuung von Studien-, Diplom- und Doktorarbeiten am Beispiel Informatik. Teubner, 5. Auflage 2005.
Justin Zobel: Writing for Computer Science. Springer, 3. Auflage 2014.
Barbara Minto: Das Prinzip der Pyramide. Pearson Studium, 2005.
Gene Zelazny: Say it with Presentations. McGraw-Hill, 2006.
Tobias Oetiker: The Not So Short Introduction to LaTeX

[*updated 24.02.2018*]

Security Engineering

Module name (EN): Security Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SE

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 4

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam, 90 minutes

[*updated 05.01.2026*]

Applicability / Curricular relevance:

DFIW-SE (P610-0194) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 4, mandatory course
KIB-SE (P222-0039) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, mandatory course
KIB-SE (P222-0039) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, mandatory course
PIB-SE (P222-0039) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, mandatory course
PIB-SE (P222-0039) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, mandatory course
PRI-SE (P222-0039) Production Informatics, Bachelor, SO 01.10.2023 , semester 4, mandatory course
PRI-SE (P222-0039) Production Informatics, Bachelor, SO 01.10.2026 , semester 4, mandatory course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 24.11.2025*]

Learning outcomes:
After successfully completing this module, students will be familiar with the critical parts, procedures and audit-relevant data of an operating system.
An open source UNIX system will be used in order to be able to comprehensively analyze processes, security gaps and system calls in detail. The knowledge of these components and their weak points will enable the students to pursue a security-by-design approach for new application systems or the configuration of operating systems, which prevents vulnerabilities from the outset.
This includes basic knowledge of current cryptography methods. Students will learn to integrate the social necessity of data protection and privacy protection in communication processes into their future concepts.

[*updated 26.02.2018*]

Module content:
1. Security terms, threat model, examples
2. Identities, authentication, authorization
3. Encryption (symmetric, asymmetric)
4. Cryptographic hash functions, message authentication codes
5. UNIX from a security perspective
6. Auditing, system status, system statistics
7. Network security, perimeter security
8. Penetration tests

[*updated 26.02.2018*]

Recommended or required reading:
D. Kim, M. G. Solomon, Fundamentals Of Information Systems Security, 2016
G. Weidman, Penetration Testing: A Hands-On Introduction to Hacking, 2014
https://www.sans.org/
http://www.securityfocus.com/vulnerabilities

[*updated 26.02.2018*]

Technical Reading and Writing

Module name (EN): Technical Reading and Writing

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-TRW

Hours per semester week / Teaching method:
2S (2 hours per week)

ECTS credits:
2

Semester: 1

Mandatory course: yes

Language of instruction:
English

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KIB-ENG2 (P222-0043) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 2, mandatory course
KIB-ENG2 (P222-0043) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 2, mandatory course
PIB-EN2 (P221-0196) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 2, mandatory course
PIB-TRW Applied Informatics, Bachelor, SO 01.10.2026 , semester 1, mandatory course
PRI-TRW (P222-0043) Production Informatics, Bachelor, SO 01.10.2023 , semester 2, mandatory course
PRI-TRW (P222-0043) Production Informatics, Bachelor, SO 01.10.2026 , semester 1, mandatory course

Suitable for exchange students (learning agreement)

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Übers. Betina Lang

Lecturer: Dipl.-Übers. Betina Lang

[*updated 20.11.2025*]

Learning outcomes:
Note:
The modules "Business Communication and Intercultural Competence", "Technical Reading and Writing", as well as "Professional Presentations" should be seen in conjunction with one another. They offer students a framework to further develop their English language skills in a professionally related area from the desired entry level B1 to level B2.

About the "Technical Reading and Writing" module:
After successfully completing this module, students will be familiar with different reading strategies and will be able to apply them to course-specific specialist texts. They will have extended their repertoire of linguistic structures and will be able to apply these structures to the written elaboration of technical questions and documents.

[*updated 12.04.2018*]

Module content:
- General and detailed comprehension of course-specific specialist texts
- Techniques for taking notes
- Summarizing texts
- Describing for example, program actions, program functions, instructions, etc.
- Cause-effect relationships

In addition, we will work on:
- Vocabulary
- Repeating relevant grammatical structures

[*updated 12.04.2018*]

Teaching methods/Media:
Teaching and learning materials (print, audio, video), multimedia teaching and learning software for specific target groups

[*updated 19.02.2018*]

Recommended or required reading:
Students will receive a list of recommended teaching and learning materials.
The following materials are free of charge for students of the htw saar. We recommend their use for independent learning:

Christine Sick (2015): TechnoPlus Englisch VocabApp (Mobile learning offer, especially for basic vocabulary, all levels), EUROKEY.

Christine Sick, unter Mitarbeit von Miriam Lange (2011): TechnoPlus Englisch 2.0 (Multimediales Sprachlernprogramm für Technisches und Business Englisch, Niveau B1-B2+), EUROKEY.

[*updated 26.02.2018*]

Theoretical Informatics

Module name (EN): Theoretical Informatics
Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026
Module code: TIB-TI
Hours per semester week / Teaching method: 4V (4 hours per week)
ECTS credits: 5
Semester: 5
Mandatory course: yes
Language of instruction: German
Assessment: Written exam [*updated 19.02.2018*]
Applicability / Curricular relevance: KIB-TI (P222-0044) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 3, mandatory course KIB-TI (P222-0044) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, mandatory course PIB-TI (P221-0041) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course PIB-TI (P221-0041) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, mandatory course
Workload: 60 class hours (= 45 clock hours) over a 15-week period. The total student study time is 150 hours (equivalent to 5 ECTS credits). There are therefore 105 hours available for class preparation and follow-up work and exam preparation.
Recommended prerequisites (modules): None.
Recommended as prerequisite for:
Module coordinator: Prof. Dr. Maximilian Altmeyer
Lecturer: Prof. Dr. Maximilian Altmeyer [*updated 24.11.2025*]

Learning outcomes:
After successfully completing this module, students will be familiar with the basic terms and concepts of theoretical informatics. They will be familiar with the characteristics of automatic machines and languages and can select and apply suitable theoretical concepts (e. g. finite automaton or pushdown automaton) for practical tasks.

[*updated 19.02.2018*]

Module content:
Mathematic principles
Regular languages
Finite automata
Nondeterminism
Regular expressions and languages
Context-free languages
Pushdown automata
Context-free grammar
Turing machines and variations
Decidability
Halting problem

[*updated 19.02.2018*]

Teaching methods/Media:
Board, script, simulation software

[*updated 19.02.2018*]

Recommended or required reading:
HOPCROFT J.E., ULLMANN J.D., MOTWANI R., Einführung in die Automatentheorie, Formale Sprachen und Komplexitätstheorie, Pearson, 2002
SIPSER Michael: Introduction to the theory of computation, Course Technology, 3rd edition, 2012

[*updated 19.02.2018*]

Technical Computer Science Bachelor - optional courses

.NET Concepts and Tools

Module name (EN): .NET Concepts and Tools

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-NETW

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI665 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-NETW (P221-0096) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-NETW (P221-0096) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI79 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-NETW (P221-0096) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-NETW (P221-0096) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific
PRI-NETW Production Informatics, Bachelor, SO 01.10.2023 , semester 4, optional course, informatics specific
PRI-NETW Production Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Thomas Beckert, M.Sc.

Lecturer: Thomas Beckert, M.Sc.

[*updated 13.01.2026*]

Learning outcomes:
Based on the content management system Umbraco, students will acquire the ability to conceptually assess Microsoft´s .NET framework and use it for the development of web portals.

They will be able to model web applications with the ASP. NET MVC pattern.

Students will be capable of creating interactive elements with the inline script engine Razor (C#).
In doing so, they will learn to extend the CMS backend. Using the SQL Management Studio, students will be able to view and modify database-driven information.

[*updated 26.02.2018*]

Module content:
1. Installing CMS Umbraco
2. .NET framework
3. MVC approach and Umbraco basics of the backend
4. Media content
5. Partial view macros
6. Grid - flexible content creation
7. Property editor
8. Umbraco API, C# and Visual Studio
9. Extending the backend
10. Database communication with PetaPoco
11. Handlers and web services in .NET
12. Search function in Umbraco
13. Multilingualism
14. Surface controller
15. Members area
16. Web application, project work/practical exercises

[*updated 26.02.2018*]

Recommended or required reading:
Will be announced in the course

[*updated 26.02.2018*]

"Engineering Visions" Intensive Program

Module name (EN): "Engineering Visions" Intensive Program

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-IPRE

Hours per semester week / Teaching method:
3PA+1S (4 hours per week)

ECTS credits:
4

Semester: 4

Mandatory course: no

Language of instruction:
English

Assessment:
Written composition with presentation

[*updated 19.02.2018*]

Applicability / Curricular relevance:

BMT553 (P222-0118) Biomedical Engineering, Bachelor, ASPO 01.10.2011 , optional course, non-technical
KI606 (P200-0014) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 4, optional course, non-technical
KIB-IPRE (P222-0118) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, optional course, non-technical
KIB-IPRE (P222-0118) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, optional course, non-technical
MAB.4.2.1.29 (P222-0118) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 3, optional course, general subject
MST.IPE (P222-0118) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 4, optional course, non-technical
MST.IPE (P222-0118) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 4, optional course, non-technical
MST.IPE (P222-0118) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 4, optional course, non-technical
PIBWN68 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 4, optional course, not informatics specific
PIB-IPRE (P222-0118) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-IPRE (P222-0118) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Martin Löffler-Mang

Lecturer: Prof. Dr. Martin Löffler-Mang

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to analyze and evaluate global challenges. They will have acquired new working techniques that will help them develop innovative and technical visions for the future. They will be familiar with the most important basic concepts of conscious communication and discussions in interdisciplinary work. They can present and document work results in an appropriate manner. In addition, students will have expanded their intercultural and foreign language skills through work in international teams.

[*updated 19.02.2018*]

Module content:
Students will discuss the challenges of today´s world and develop technical visions for what they believe life on earth will be like in 10 to 50 years. In international project groups, they will develop and discuss their own technical visions from fields such as bionics, mechatronics, nanotechnology, intelligent materials, renewable energies, optical technologies and information technologies (selection) for a sustainable life on earth.

[*updated 24.02.2018*]

Teaching methods/Media:
The initial phase will focus on inspiring, future-oriented lectures by our speakers on technical topics of the future. The goal of these lectures is to motivate the students and inspire their conceptual work. The lectures will be accompanied by workshops on creative techniques (brainstorming, mind mapping, World Café etc.) and team building.
During the main phase, students will work autonomously in groups supported by mentors (lecturers from our partner universities). At the end of each day, together with the lecturers, he students will reflect on their own results, as well as those from the other groups.
The intensive program will end with a presentation and self-assessment of each group´s results in the form of a marketplace.

[*updated 24.02.2018*]

Recommended or required reading:
Project-related literature

[*updated 19.02.2018*]

Applied Computer Science Seminar

Module name (EN): Applied Computer Science Seminar

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SAI

Hours per semester week / Teaching method:
2S (2 hours per week)

ECTS credits:
3

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Presentation/discussion (obligation to attend all presentations), term paper

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI594 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-SAI (P221-0092) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-SAI (P221-0092) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI47 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-SAI (P221-0092) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-SAI (P221-0092) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. André Miede

Lecturer: Prof. Dr.-Ing. André Miede

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to describe and explain the basic forms of scientific work (literature research, argumentation). They will apply this knowledge to prepare both a scientific presentation and a seminar paper.

[*updated 19.02.2018*]

Module content:
During the course, the necessary methodical and
technical basics will first be taught and then intensified through practical exercises.

At the same time, students will be assigned their topic for the research project and then work independently on these topics.

1. Methodological basics
 o Scientific work
 o Structuring arguments
 o Seminar lectures and presentations
2. Technical basics
 o Introduction to LaTeX
 o Reference management
 o Using templates (IEEE)
3. Seminar
 o Processing current topics according to the chosen topic
 o Presentation of the results to the group
 o Group discussion and exchange
 o Written composition (term paper)
 o Group discussion and exchange
 o Written composition (term paper)

[*updated 19.02.2018*]

Teaching methods/Media:
Transparencies/beamer, board, coaching, homework, group discussions, student presentations, written exercises

[*updated 19.02.2018*]

Recommended or required reading:
Martin Kornmeier: Wissenschaftlich Schreiben leicht gemacht, utb, 2013.
Marcus Deininger, Horst Lichter, Jochen Ludewig, Kurt Schneider:
Student research projects: Ein Leitfaden zur Vorbereitung, Durchführung und Betreuung von Studien-, Diplom- und Doktorarbeiten am Beispiel Informatik. Teubner, 3. Auflage 1996.
Justin Zobel: Writing for Computer Science. Springer, 2. Auflage 2009.
Barbara Minto: Das Prinzip der Pyramide. Pearson Studium, 2005.
Gene Zelazny: Say it with Presentations. McGraw-Hill, 2006.
Tobias Oetiker: The Not So Short Introduction to LaTeX

[*updated 19.02.2018*]

Automated Software Development

Module name (EN): Automated Software Development

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ASE

Hours per semester week / Teaching method:
2V+2PA (4 hours per week)

ECTS credits:
5

Semester: 4

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 28.02.2024*]

Applicability / Curricular relevance:

KIB-ASE (P221-0201) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, optional course, telecommunications-specific
PIB-ASE (P221-0201) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-ASE (P221-0201) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Martin Burger

Lecturer: Prof. Dr.-Ing. Martin Burger

[*updated 13.01.2026*]

Learning outcomes:

[*updated 28.02.2024*]

Module content:

[*updated 28.02.2024*]

Recommended or required reading:

[*updated 28.02.2024*]

Automotive Engineering

Module name (EN): Automotive Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ATEC

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

E1614 (P200-0003) Electrical Engineering, Bachelor, ASPO 01.10.2012 , semester 6, mandatory course
E2433 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, technical
KI620 (P200-0003) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-ATEC (P222-0111) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-ATEC (P222-0111) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI33 (P200-0003) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-ATEC (P200-0003) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-ATEC (P200-0003) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Horst Wieker

Lecturer: Prof. Dr. Horst Wieker

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will have developed an understanding of how information is generated and distributed within a vehicle.
Students will be able to name the advantages and disadvantages of bus systems, as well as the various fields of application
where bus systems are normally used.
In addition, students will be able to list the data typically generated in modern vehicles and the connections between this data and assistance systems. Students will be aware of the fundamental problems of automated driving and its connection with telematics systems.

Students will be capable of demonstrating the basic motivation behind Cooperative Intelligent Transports Systems (C-ITS). They will be able to
reconstruct the basic standardization use cases and explain how messages are structured using given scenarios. Students will be capable of solving routing problems by calculating the best propagation path. Lastly, they will be able to explain how information from vehicle bus systems is used in the context of automated driving.

[*updated 26.02.2018*]

Module content:
This course will give students an insight into automotive engineering and explain how data is generated and communicated in this field.

1. Overview of different bus systems, in particular CAN
2. Introduction to driver assistance systems
3. Introduction to automated driving
4. Introduction to V2X communication
5. V2X communication use cases
6. Protocols and algorithms in V2X communication

[*updated 26.02.2018*]

Teaching methods/Media:
Beamer, board

[*updated 19.02.2018*]

Recommended or required reading:

[*still undocumented*]

Basic Principles Governing the Qualification of Trainers and Instructors in Germany's Dual Education and Vocational Training System

Module name (EN): Basic Principles Governing the Qualification of Trainers and Instructors in Germany´s Dual Education and Vocational Training System

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-AUSB

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

E1582 Electrical Engineering, Bachelor, ASPO 01.10.2012 , optional course
EE-K2-546 Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015 , optional course, engineering
E2582 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, general subject
FT63 Automotive Engineering, Bachelor, ASPO 01.04.2016 , semester 5, optional course, technical
FT63 Automotive Engineering, Bachelor, ASPO 01.10.2019 , semester 5, optional course, technical, course inactive since 28.10.2021
KI611 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-AUSB Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6,

optional course, non-technical
KIB-AUSB Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.20 (P200-0013) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 4, optional course
MST.GAU Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , optional course, non-technical
MST.GAU Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , optional course, non-technical
MST.GAU Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course, non-technical
PIBWN66 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-AUSB Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-AUSB Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific
MST.GAU Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Studiendekan

Lecturer: Studiendekan

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be familiar with the legal regulations that apply to vocational training and can implement them responsibly. They will have all of the knowledge necessary for the successful completion of the instructor qualification test at the Chamber of Industry and Commerce (IHK). Students will be capable of training young people in a company in accordance with legal, technical and organizational guidelines and helping their trainees successfully complete their training.

[*updated 26.02.2018*]

Module content:
- Planning and testing vocational training requirements
- Preparing vocational training and participating in the recruitment of trainees
- Carrying out vocational training
- Completing vocational training

[*updated 19.02.2018*]

Teaching methods/Media:
Transparencies

[*updated 19.02.2018*]

Recommended or required reading:
Ausbilder-Eignungsverordnung, Rahmenplan mit Lernzielen, Publisher: DIHK - Deutscher Industrie- und Handelskammertag e. V., Berlin 2009

[*updated 19.02.2018*]

Brain-Computer Interface

Module name (EN): Brain-Computer Interface

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-BCI

Hours per semester week / Teaching method:
1V+3PA (4 hours per week)

ECTS credits:
6

Semester: according to optional course list

Mandatory course: no

Language of instruction:
English/German

Assessment:
Project with presentation

[*updated 27.04.2021*]

Applicability / Curricular relevance:

BMT2613.BCI (P221-0183) Biomedical Engineering, Bachelor, ASPO 01.10.2018 , semester 6, optional course
BMT2613.BCI (P221-0183) Biomedical Engineering, Bachelor, SO 01.10.2025 , semester 6, optional course
KIB-BCI Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course, informatics specific
KIB-BCI Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, informatics specific
MTM.BCI (P231-0128) Mechatronics, Master, ASPO 01.04.2020 , optional course, technical
MST2.BCI Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , optional course
MST2.BCI Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course
PIB-BCI (P221-0183) Applied Informatics, Bachelor, ASPO 01.10.2022 , optional course, informatics specific
PIB-BCI (P221-0183) Applied Informatics, Bachelor, SO 01.10.2026 , optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 180 hours (equivalent to 6 ECTS credits).
There are therefore 135 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Dr. Daniel Strauß

Lecturer: Prof. Dr. Dr. Daniel Strauß

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to apply their basic knowledge about biosignal processing as it relates to movements of collaborative robots.

Based on their interdisciplinary knowledge of programming and biosignal processing, they will be able to solve simple tasks involving collaborative industrial robots and then record and interpret the relevant neural activity data and control the robot.

Students will be able to collaborate with students from other disciplines (BMT, Computer Science, Mechatronics) in their project assignments and in doing so, use different skills.

In addition to professional qualifications, students will have acquired experience in assuming professional and organizational responsibility within their (interdisciplinary) project team.

As study participants, students will have learned essential soft skills in dealing with subjects and patients.

[*updated 27.04.2021*]

Module content:
The basics of direct dialog between man and machine

Setting up experiments to measure and detect relevant patterns in human neural signals, in particular the electroencephalogram (EEG)

The interpretation and analysis of neural signals by means of signal processing and pattern recognition to control a robot

Simple programming of collaborative industrial robots

Handling robot hardware and system-dependent scripting language (based on UR as an example)

Implementing the control of the robot hardware based on interpreted data

[*updated 27.04.2021*]

Teaching methods/Media:
Lecture, practical exercises, workshop/training, meeting

[*updated 27.04.2021*]

Recommended or required reading:
Bruce, Eugene N.: Biomedical Signal Processing and Signal Modeling, John Wiley & Sons, 2001
Nunez, Paul L; Shrinivasan, Ramesh: Electric Fields of the Brain: the neurophysics of EEG, Oxford University Press, 1991
Semmlow, John L.: Biosignal and Biomedical Image Processing, Marcel Dekker, 2004
Clément, Claude. Brain-Computer Interface Technologies, Springer, 2019
http://www.i-botics.de/wp-content/uploads/2016/08/UR3_User_Manual_de_Global.pdf
https://www.universal-robots.com/download/?option=15833

[*updated 27.04.2021*]

Broadband Technology and its Applications

Module name (EN): Broadband Technology and its Applications

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-BBTA

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI612 (P222-0079) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-BBTA Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-BBTA Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIB-BBTA Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-BBTA Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).

There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Horst Wieker

Lecturer: Prof. Dr. Horst Wieker

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to apply basic knowledge of the technologies used (e. g.: GPON, IP multicast, RF Overlay, VDSL2+) in a structured manner. This will enable them to design broadband areas and create and evaluate business cases.

[*updated 26.02.2018*]

Module content:

TC Broadband Expansion of FTTX Areas

-Services:
Telephony (TDM vs. VoIP)
Broadband Internet
Home office workstations
Broadcast TV (RF Overlay vs. IPTV)
Video on demand
Online gaming

- Situation and current and future requirements

- Technologies
FTTH (GPON, Active Ethernet)
FTTB (LWL, VDSL2+)
FTTC (VDSL2+, bonding, vectoring)

- Business case examples

[*updated 26.02.2018*]

Recommended or required reading:
Most of the relevant literature for this topic is available online:

http://en.wikipedia.org/wiki/Fiber_to_the_x
http://de.wikipedia.org/wiki/Glasfasernetz
http://de.wikipedia.org/wiki/Gigabit_Passive_Optical_Network
http://en.wikipedia.org/wiki/Very-high-bit-rate_digital_subscriber_line_2

[*updated 26.02.2018*]

CAX Basics and Applications

Module name (EN): CAX Basics and Applications

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-CAX

Hours per semester week / Teaching method:
2V+2U (4 hours per week)

ECTS credits:
5

Semester: 3

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam, 90 min.

[*updated 05.11.2025*]

Applicability / Curricular relevance:

KIB-CAX (P223-0006) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 3, optional course, technical
KIB-CAX (P223-0006) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 3, optional course, technical
MAB_19_4.2.1.38 (P223-0006) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019 , semester 3, optional course, technical
MST2.CAX (P223-0006) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 3, optional course
PIB-CAX (P223-0006) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 3, optional course, not informatics specific
PIB-CAX (P223-0006) Applied Informatics, Bachelor, SO 01.10.2026 , semester 3, optional course, not informatics specific
PRI-CAX (P223-0006) Production Informatics, Bachelor, SO 01.10.2023 , semester 3, mandatory course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Pascal Stoffels

Lecturer: Prof. Dr.-Ing. Pascal Stoffels

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to describe and classify IT tools used in product development.
They will be able to present challenges associated with the use of these tools.
Students will be able to create virtual models using a CAD system, such as Siemens NX, and its basic functions and commands.

[*updated 02.12.2025*]

Module content:
Basics
Gearbox basics
M-CAD
ERP/PPS
PDM/PLM
Digital production planning
Virtual commissioning

[*updated 05.11.2025*]

Teaching methods/Media:
Practical exercises in the computer room with a modern CAD system.

[*updated 05.11.2025*]

Recommended or required reading:
Susanna Labisch, Georg Wählisch: Technisches Zeichnen - Eigenständig lernen und effektiv üben, 2020
Ulrich Kurz, Herbert Wittel: Böttcher/Forberg Technisches Zeichnen, 2010
Sándor Vajna Hrsg. , Andreas Wünsch: NX 11 für Einsteiger - kurz und bündig, 2017
Sándor Vajna, Christian Weber, Klaus Zeman, Peter Hehenberger, Detlef Gerhard, Sandro Wartzack: CAx für Ingenieure, 2018
Jörg Feldhusen, Karl-Heinrich Grote (Hrsg.): Pahl/Beitz Konstruktionslehre, 2013
Herbert Wittel, Dieter Muhs, Dieter Jannasch, Joachim Voßiek: Roloff/Matek Maschinenelemente, 2013
Decker, Kabus: Decker Maschinenelemente, 2018

[*updated 05.11.2025*]

Cloud Computing

Module name (EN): Cloud Computing

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-CCOM

Hours per semester week / Teaching method:
2V+2PA (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

KI699 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-CCOM (P221-0066) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-CCOM (P221-0066) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI18 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-CCOM (P221-0066, P221-0181) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-CCOM (P221-0066, P221-0181) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific
PRI-CCOM Production Informatics, Bachelor, SO 01.10.2023 , semester 4, optional course, informatics specific
PRI-CCOM Production Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Markus Esch

Lecturer: Prof. Dr. Markus Esch

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to name the basic concepts and service models of cloud computing. They will be able to explain the technological foundations of cloud computing and describe modern architectures.

Students will be able to describe advantages and disadvantages, as well as differences to traditional server-based applications, especially in terms of scalability and availability, and will be able to recognize the relationship between architecture and scalability.

Within the framework of a project, students will learn how to work together in small groups and will be able to design and implement scalable cloud-based applications.

[*updated 24.02.2018*]

Module content:
1. Cloud computing architectures, concepts and technologies
   - IaaS, PaaS, SaaS
   - distributed key-value stores
   - distributed file systems
   - distributed hash tables
   - gossiping
   - load balancing
   - consistency
   - error tolerance
   - microservices
2. Cloud computing from a developer´s perspective
   - developing cloud-based applications
   - tools and procedures

[*updated 24.02.2018*]

Teaching methods/Media:
Lecture slides, annotated lecture slides as a script, program examples, project work

[*updated 24.02.2018*]

Recommended or required reading:
Christoph Fehling, Frank Leymann, Ralph Retter, Walter Schupeck, Peter Arbitter: Cloud Computing Patterns: Fundamentals to Design, Build, and Manage Cloud Applications, Springer, 2014

Kenneth P Birman: Guide to Reliable Distributed Systems: Building High-Assurance Applications and Cloud-Hosted Services, Springer, 2012

Thomas Erl: Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013

Thomas Erl and Robert Cope: Cloud Computing Design Patterns, Prentice Hall, 2015

Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, Mike Amundsen: Microservice Architecture: Aligning Principles, Practices, and Culture, O_Reilly, 2016

[*updated 24.02.2018*]

Compiler Construction

Module name (EN): Compiler Construction

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-CBAU

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Oral examination, project, presentation

[*updated 30.07.2021*]

Applicability / Curricular relevance:

KI675 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-CBAU (P221-0067) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-CBAU (P221-0067) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI55 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-CBAU Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-CBAU Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:

60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Markus Esch

Lecturer: Prof. Dr. Markus Esch

[*updated 13.01.2026*]

Learning outcomes:
Learning outcomes:
Importing and, if necessary, translating custom file formats are basic tasks that computer scientists and programmers are regularly confronted with.
Based on the typical structure of a compiler, students will learn about the individual steps of importing, analyzing and translating a (formal) language (source language) into another (formal) language (target language), understand those steps and be able to apply them in their own project.

After successfully completing this module, students will: be familiar with the the individual modules of a compiler/translator.
- understand how lexers and parsers work and can be automatically generated from specifications,
- understand how the steps in generating code map high-level language to assembly language using C-to-CMa as an example,
- be familiar with the most important program analyses and optimizations that compilers usually perform (available expressions, interval analysis, constant propagation, dead variables, etc.).

In their project, students will develop their own compiler for a programming language they designed themselves.

[*updated 02.12.2025*]

Module content:
1. Introduction (high-level programming languages, implementation of programming languages)
2. Lexing
3. Parsing
4. Generating code
5. Code optimization
6. Project work

[*updated 04.09.2023*]

Recommended or required reading:
A. AHO, R. SETHI, J. ULLMAN: Compilers
R. WILHELM, D. Maurer: Übersetzerbau: Theorie, Konstruktion, Generierung
R. WILHELM, H. SEIDL: Übersetzerbau. Virtuelle Maschinen
H. SEIDL, R. WILHELM, S. HACK: Compiler Design: Syntactic and Semantic Analysis
H. SEIDL, R. WILHELM, S. HACK: Übersetzerbau. Analyse und Transformation

[*updated 04.09.2023*]

Computer Science and Society Seminar

Module name (EN): Computer Science and Society Seminar

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SCSS

Hours per semester week / Teaching method:
2S (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Presentation/discussion (obligation to attend all presentations), research project

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI602 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-SCSS (P221-0128) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-SCSS (P221-0128) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
PIBWI64 (P221-0128) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-SCSS (P221-0128) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, not informatics specific
PIB-SCSS (P221-0128) Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. André Miede

Lecturer: Prof. Dr.-Ing. André Miede

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to describe and explain the foundations of scientific work (literature review, logical arguments). They will be able to apply these skills by preparing a scientific presentation and a written seminar paper.

[*updated 19.02.2018*]

Module content:
The course teaches the necessary methodological and technical foundations for developing a presentation and seminar paper. This is supported by practical exercises. Together with the professor, the students will select a suitable topic to work on independently during the semester.

1. Methodological foundations
 o Working with scientific methods
 o Structuring ideas and arguments
 o Presenting ideas and arguments
2. Technical foundations
 o Introduction to LaTeX
 o Bibliography management
 o Using an official template (IEEE)
3. Seminar
 o Independent work on individual topic (own idea/suggestions from professor)
 o Presentation of initial results to the group
 o Discussion and exchange with the group
 o Submission of written seminar paper

[*updated 19.02.2018*]

Teaching methods/Media:
Transparencies, projector, board, presentations by the students and discussion

[*updated 19.02.2018*]

Recommended or required reading:
Martin Kornmeier: Wissenschaftlich Schreiben leicht gemacht, utb, 2013.
William Strunk, Jr.; Elywyn B. White: The Elements of Style, Longman, 1999.
Justin Zobel: Writing for Computer Science. Springer, 2. Auflage 2009.
Barbara Minto: Das Prinzip der Pyramide. Pearson Studium, 2005.
Gene Zelazny: Say it with Presentations. McGraw-Hill, 2006.
Marcus Deininger, Horst Lichter, Jochen Ludewig, Kurt Schneider: Studien-Arbeiten: Ein Leitfaden zur Vorbereitung, Durchführung und Betreuung von Studien-, Diplom- und Doktorarbeiten am Beispiel Informatik. Teubner, 3. Auflage 1996.
Tobias Oetiker: The Not So Short Introduction to LaTeX

[*updated 26.02.2018*]

Computer Science in the Media

Module name (EN): Computer Science in the Media

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SIDM

Hours per semester week / Teaching method:
2S (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German/English

Assessment:
Seminar presentation, discussion (obligation to attend all presentations), term paper

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI697 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-SIDM Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-SIDM Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI27 (P221-0129) Applied Informatics, Bachelor, ASPO 01.10.2011 , optional course, informatics specific
PIB-SIDM (P221-0129) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-SIDM (P221-0129) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Klaus Berberich

Lecturer: Prof. Dr. Klaus Berberich

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to independently access, process and reproduce the content of a scientific publication, both orally and in writing. In addition, they will be able to actively participate in a technical discussion.

[*updated 26.02.2018*]

Module content:
Computer science is increasingly influencing our everyday life. Therefore, it is not surprising that current results from computer science research are also presented to a broader public in the media. This seminar will look at current publications from the field of computer science research (in English) together with the corresponding media coverage (in English or German).

In a lecture, (approx. 30 minutes), each participant will present a selected scientific publication, with special emphasis on how technical details in media reporting are simplified and technical terminology is avoided. In order to facilitate a lively discussion, all participants should be familiar with media coverage, but not with the scientific publication itself. The collected findings will be summarized in a seminar paper (approx. 6 pages).

[*updated 26.02.2018*]

Recommended or required reading:
Helmut Balzert, Marion Schröder und Christian Schäfer: Wissenschaftliches Arbeiten,
Springer 2017

Marcus Deininger, Horst Lichter, Jochen Ludewig, Kurt Schneider: Studien-Arbeiten: Ein Leitfaden zur Vorbereitung, Durchführung und Betreuung von Studien-, Diplom- und Doktorarbeiten am Beispiel Informatik.
Teubner, 5. Auflage 2005.

William Strunk, Jr. and Elywyn B. White: The Elements of Style,
Longman, 1999.

Justin Zobel: Writing for Computer Science,
Springer, 3. Auflage, 2015

[*updated 14.05.2025*]

Computer Vision

Module name (EN): Computer Vision

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-CVIS

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI692 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-CVIS (P221-0069) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-CVIS (P221-0069) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
MST.CVI (P221-0069) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course, technical
MST.CVI (P221-0069) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course, technical
MST.CVI (P221-0069) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course, technical
PIBWI83 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-CVIS (P221-0069) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-CVIS (P221-0069) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific
MST.CVI (P221-0069) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 6, optional course, technical

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Gerald Kroisandt

Lecturer: Prof. Dr. Gerald Kroisandt

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to explain and apply image processing algorithms such as noise reduction and deblurring. They will be familiar with the design of digital filters. They will be able to manipulate images without using image editing software.

In addition, they will also be able to apply methods that can detect moving objects in a film, reconstruct 3D information based on images and improve the quality of 2D images. Students will learn how robots _see_.

[*updated 19.02.2018*]

Module content:
* Digitization of analog images
* Image transformations (e.g. linear filters, math. Morphology, diffusion filters, wavelet shrinkage, deblurring)
* Color perception and color spaces
* Image editing
* Feature extraction (edges, corners, lines and circles)
* Segmentation
* Extraction of 3D information
* Object detection

[*updated 19.02.2018*]

Teaching methods/Media:
100% of the lecture will take place in the PC lab AMSEL "Angewandte Mathematik, Statistik und eLearning". Computer-supported practical case studies will be worked through using the algorithms taught in this module.

In addition, the eLearning system MathCoach (AMSEL PC laboratory 5306) will be used.

[*updated 24.02.2018*]

Recommended or required reading:
R.C. Gonzalez, R.e. Woods: Digital Image Processing, Addison-Wesley, SE 2002
K.R. Castelman: Digital Image Procesing, Prentice Hall, 1996
R.Jain, R.Kasturi, B.G. Schunck: Machine Vision, McGraw, 1995
E.Trucco, A. Verri: Introductory Techniques for 3-D Computer Vision, Prentice Hall,1995
R.Klette, K.Schlüns, A.Koschan: Computer Vision:Three-Dimensional Data from Images, Springer, 1998

[*updated 19.02.2018*]

Design Patterns

Module name (EN): Design Patterns

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-EWM

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Oral examination

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI681 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-EWM (P221-0210) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-EWM (P221-0210) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI73 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-EWM (P221-0210) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-EWM (P221-0210) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 45 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Martin Burger

Lecturer: Prof. Dr.-Ing. Martin Burger

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will:
_ know the differences between architectural patterns, software design patterns, and programming idioms and be able to explain them.
_ be familiar with the most important architectural patterns and can explain their application context and structure
_ be familiar with the most important software design patterns, their application contexts, structure and dynamics and can illustrate this with examples.
_ understand the structure and use of JUnit.
_ have an overview of refactoring methods and can explain them using code examples.

[*updated 19.02.2018*]

Module content:
1. Introduction to software design patterns
   1.1 General information
   1.2 Pattern categories
   1.2 Patterns and software architectures

2. Architectural patterns
   2.1 Multi-tier patterns
   2.2 Broker pattern
   2.3 Model-view-controller
   2.4 Other architectural patterns

3. Software design patterns and applications
   3.1 Creational patterns
   3.2 Structural patterns
   3.3 Behavioral design patterns

4. Introduction to JUnit
   4.1 Unit tests with JUnit
   4.2 The design of JUnit 3.8.x
   4.3 Annotations
   4.4 JUnit 4.x

5. Refactoring and patterns
   5.1 Introduction to software metrics
   5.2 Introduction to refactoring
   5.3 Refactoring and patterns

6. Introduction to aspect-oriented software development (optional)
   6.1 Aspect-oriented software development overview
   6.2 Application examples for aspect-oriented software development
   6.3 Aspect-oriented software development and patterns

[*updated 19.02.2018*]

Teaching methods/Media:
Transparencies, projector, board
Course-specific website

[*updated 19.02.2018*]

Recommended or required reading:
Geirhos, Matthias:
Entwurfsmuster _ Das umfassende Handbuch
Rheinwerk Verlag GmbH, Bonn

Goll, Joachim:
Architektur- und Entwurfsmuster der Softwaretechnik
Springer Vieweg

Gamma, E.; Helm, R.; Johnson, R.; Vlissides, J.:
Entwurfsmuster: Elemente wiederverwendbarer objektorientierter Software
Addison-Wesley

Fowler, Martin: Refactoring
Oder wie Sie das Design vorhandener Software verbessern.
Addison-Wesley

[*updated 19.02.2018*]

Digital Production Systems

Module name (EN): Digital Production Systems

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-DPS

Hours per semester week / Teaching method:
2V+2S (4 hours per week)

ECTS credits:
5

Semester: 4

Mandatory course: no

Language of instruction:
German

Assessment:

[*updated 15.04.2024*]

Applicability / Curricular relevance:

KIB-DPS (P222-0133) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, optional course, technical
KIB-DPS (P222-0133) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, optional course, technical
PIB-DPS (P222-0133) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-DPS (P222-0133) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific
PRI-DPS (P222-0133) Production Informatics, Bachelor, SO 01.10.2023 , semester 4, mandatory course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Pascal Stoffels

Lecturer: Prof. Dr.-Ing. Pascal Stoffels

[*updated 13.01.2026*]

Learning outcomes:
The module covers the information systems and processes for the operation of production systems.

After successfully completing this module, students will be familiar with operational information systems for planning and controlling production systems. In addition, they will have insight into the consolidation and analysis of available data and the development of strategies for the digitalization of business processes.

They will also have an overview of the data required for planning and control and will be able to model business processes.

[*updated 15.04.2024*]

Module content:
Business Information Systems (Enterprise Resource Planning, production planning und -control, Manufacturing Execution System,), Data Warehouse

Computer Aided Quality Planning, data organization and analysis, digitalization of business processes, entity-relationship model

[*updated 15.04.2024*]

Recommended or required reading:

[*updated 15.04.2024*]

Digital Signal Processing

Module name (EN): Digital Signal Processing

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-DSIG

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
4

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 20.03.2007*]

Applicability / Curricular relevance:

KI560 (P200-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, mandatory course
KIB-DSIG (P200-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course
KIB-DSIG (P200-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Martin Buchholz

Lecturer: Prof. Dr. Martin Buchholz

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to carry out digital signal processing and analyze telecommunications signals and systems. They will know the different structures of discrete time systems and can analyze them analytically with the help of the discrete Fourier transform and the Z-transform. Students will know how to examine digital systems using Matlab and be familiar with the basic features of a simulation tool such as Simulink and SPW (Signal Processing Workstation). The acquired skills in designing digital algorithms and filters will be intensified in an FPGA as part of the simulation and implementation.
Students will thus, be able to apply their knowledge to complex telecommunication systems and implement the required digital algorithms independently in their later professional life or during the Master program.

[*updated 19.02.2018*]

Module content:
1. Introduction
Ideal and real sampling, sampling theorems, practical aspects of scanning
2. Discrete time signals and systems
   Discrete folding, FIR and IIR systems
3. Structure of discrete time systems
4. Representation of discrete time signals and systems in the frequency domain
5. The Z-transform
   Stability
6. Simulation of algorithms for digital signal processing
7. Implementation in hardware

Matlab examples and exercises will be provided for all chapters.

[*updated 30.07.2021*]

Teaching methods/Media:
Script, projector, Matlab and SPW Simulation software in the PC room, implementation in FPGA evaluation boards

[*updated 19.02.2018*]

Recommended or required reading:
Oppenheim, A. V.; Schafer, R. W.: Zeitdiskrete Signalverarbeitung, Oldenbourg Verlag, 1999
Stearns, S.D.; Hush D.R.: Digitale Vararbeitung analoger Signale, Oldenbourg, 1999
Von Grünigen, D. Ch.: Digitale Signalverarbeitung, Carl-Hanser Verlag, 2004
Kammeyer, K.-D. / Kroschel K.: Digitale Signalverarbeitung Filterung und Spektralanalyse, Teubner
Goetz, H.: Einführung in die digitale Signalverarbeitung, Teubner Verlag, 1998
Werner, M.: Digitale Signalverarbeitung mit Matlab, Intensivkurs mit 16 Versuchen, Vieweg, 2006
Brigham, E.O.: FFT Anwendungen, Oldenbourg, 1997

[*updated 30.07.2021*]

Digital Television Technology

Module name (EN): Digital Television Technology

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-DIGF

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Oral examination

[*updated 20.03.2007*]

Applicability / Curricular relevance:

KI643 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-DIGF Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-DIGF Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIB-DIGF Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-DIGF Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Martin Buchholz

Lecturer: Prof. Dr. Martin Buchholz

[*updated 13.01.2026*]

Learning outcomes:
After successful completion of this module, students will be able to classify and describe the basics of studio technology, source coding (audio and video coding) and channel coding (error protection), as well as the necessary transmission technology and its technical implementation. This will enable them to apply the most important methods of video coding (MPEG-4, H. 264) and transmission standards in their fields of application and assess them with regard to efficiency, complexity and their interactions in the subsystems.

[*updated 26.02.2018*]

Module content:
1. Overview and introduction
   History of television, basics of analog television technology,
   Transition to digital television

2. Recording technology and digitalization of audio and video signals

3. Redundancy and irrelevance reduction (source coding)
   Data reduction, Huffman code, DCT,
   Video and audio encoding, MPEG-2, MPEG-4, DivX

4. Error protection methods (channel coding)

5. Digital television signal transmission
   Transmission via different transmission media:
   Cable, satellite, terrestrial

6. Mobile TV broadcasting and technological convergence
   Doppler shift, multipath propagation, diversity reception
   New digital video services, technological convergence, IP datacasting

[*updated 26.02.2018*]

Recommended or required reading:
Reimers, U., Digitale Fernsehtechnik
Strutz/Mildenberger, Bilddatenkompression
Bossert, Kanalcodierung

[*updated 26.02.2018*]

Electromobility

Module name (EN): Electromobility

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-EMOB

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

E2533 (P211-0211) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, technical
FT62 (P211-0211) Automotive Engineering, Bachelor, ASPO 01.04.2016 , semester 6, optional course, specialisation
FT62 (P211-0211) Automotive Engineering, Bachelor, ASPO 01.10.2019 , semester 6, optional course, specialisation, course inactive since 18.01.2024
KI617 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-EMOB (P211-0211) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-EMOB (P211-0211) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI59 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-EMOB (P211-0211) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-EMOB (P211-0211) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Horst Wieker

Lecturer: Prof. Dr. Horst Wieker

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will understand new and adapted vehicle systems and be able to describe different market requirements against the background of market trends. They will be able to characterize the functional structure of the systems and their interfaces and identify solutions to typical problems.

[*updated 26.02.2018*]

Module content:
This course will focus on trends, technology and system networking in and outside of vehicles.

The electrification of the automobile occupies a strong position in the global market. The transition from the combustion engine to pure electric driving have led to a wide range of new systems and information networks in vehicles.

This course will deal with the following questions:
* What are the main differences between a vehicle with an internal combustion engine and a hybrid or electric car and what effects do these differences have on the function development?
* How do electronic systems and networks work in an electric car?
* Are there special functional requirements for assistance systems in electric vehicles?
* What do the data networks look like in the future vehicles and what requirements do they have to meet?

1. General information on market trends and their technical requirements
   * User behavior
   * Political influences
2. General technical principles
   * Gasoline engines
   * Diesel engines
   * Hybrid vehicles
   * Electric vehicles
3. The architecture of electric vehicles
   * Drive systems
   * Chassis & safety systems
   * Vehicle cabin systems
   * High-voltage architectures
4. Driver assistance systems
   * Overview of functionalities and networks
   * Limits of driver assistance systems
5. Communication systems inside and outside vehicles
   * ITS and electric vehicles
   * Data networks
6. Functional safety
   * General requirements for security and privacy
   * Redundancies
   * Requirements for assistance and security systems
   * Road vehicles - Functional safety ISO 26262

[*updated 26.02.2018*]

Recommended or required reading:

[*still undocumented*]

Embedded Linux

Module name (EN): Embedded Linux

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-EMBL

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
4

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI689 (P221-0074) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-EMBL Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-EMBL Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI31 (P221-0074) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, technical
PIB-EMBL Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-EMBL Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Inf. Ulrich Bruch

Lecturer: Dipl.-Inf. Ulrich Bruch

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be familiar with system design and programming techniques for embedded applications.
They will be able to use and customize bootloaders.
They will have acquired experience in working with real-time operating systems such as FreeRTOS.
Students will be capable of working with embedded Linux e. g. on a single board computer (Raspberry etc.).
They will be able to design simple, embedded systems.
They will have the know-how to use basic IoT technologies (e.g. 6LoWPan, COAP, MQTT,...).

[*updated 26.02.2018*]

Module content:
1. Introduction to the terms used in embedded Linux
2. Review course "Embedded Computing", build process, toolchain, cross compiler
3. Special mechanisms and techniques for the realization of bootloaders
4. Micro operating systems, structure, function, implementation, application - problem discussions
5. Embedded Linux using the example of a single-board computer - implementation of simple tasks in user space, meaning and limits of embedded Linux, insight into kernel driver development using the example of a
Push button.
6. Use of embedded systems for the Internet of Things using a small weather station as an example, presentation of common protocols and methods

Topics 2 to 5 will be accompanied by exercises.

[*updated 26.02.2018*]

Recommended or required reading:
Wolfgang Matthes "Embedded Electronics 1", Elektor-Verlag
Wolfgang Matthes "Embedded Electronics 2", Elektor-Verlag
Jürgen Wolf ?Cvon A bis Z?, Galileo Computing
Hans Werner Lang "Algorithmen", Oldenbourg
Jörg Wiegelmann "Softwareentwicklung in C für Mikroprozessoren und Mikrocontroller", Hüthig Verlag
Using the FreeRTOS Real time kernel (e-book at www.freertos.org [www.freertos.org])
FreeRTOR Reference Manual (e-book at www.freertos.org [www.freertos.org])
Jürgen Quade "Embedded Linux"
Jürgen Quade "Linux Treiber entwickeln"
Ralf Jesse "Embedded Linux mit Raspberry Pi und Co."

[*updated 26.02.2018*]

Enterprise Java Beans

Module name (EN): Enterprise Java Beans

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-EJB

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI619 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-EJB (P221-0105) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-EJB (P221-0105) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI49 (P221-0105) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-EJB (P221-0105) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-EJB (P221-0105) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Martin Burger

Lecturer: Prof. Dr.-Ing. Martin Burger

[*updated 13.01.2026*]

Learning outcomes:
- Students will be able to implement enterprise applications using the JavaEE 6 framework and run them on the JBoss application server.

- They will have basic knowledge of the JBoss configuration, understand how the application server works, and will be familiar with the main programming features of Java EE using the JBoss 6 AS (EJB 3.0 / 3.1).

- They will be familiar with the integrated development environment Eclipse and the resulting advantages in the field of Java EE / JBoss development.

- They will be capable of developing, testing, debugging and commissioning complex client-server applications.

- They will be familiar with the most important design patterns of software development and their use in Java EE6, the tool _Ant_ for automated building and the _Log4j_ library for logging information into the log files of the application server.

[*updated 26.02.2018*]

Module content:
1. Introduction The Bean concept, _Hello World_ with EJB and JBoss application server
2. History: Comparison of J2EE 1.1, Java EE 5 and Java EE 6, JBoss development stages
3. JBoss application server: Structure, functionality and basic configuration, reading log files, elementary terms
4. Eclipse IDE: Setting up an environment for the efficient development of Java Enterprise applications, configuring, creating user libraries, debugging a running JBoss application (remote debugging), using ANT as a build tool
5. Enterprise Java Beans (EJB): bean types, interaction of beans, transaction principles (bean-managed, container-managed), lifecycle of beans
6. Java Persistence API (JPA): Data access layer: EntityManager, object-relational mapping, queries with JPQL, performance enhancement, transactions
7. Java Message Services: Message-Driven Beans
8. Testing: Test-driven development with JUnit
9. Further topics: Web services, EJB Interceptors, EJB Security

[*updated 26.02.2018*]

Recommended or required reading:
Jamae, Javid: JBoss im Einsatz , Carl Hanser Verlag
Werner Eberling: Enterprise Java Beans 3.1, Carl Hanser Verlag

[*updated 26.02.2018*]

Error-Identification and Error-Correcting Codes

Module name (EN): Error-Identification and Error-Correcting Codes

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FFKC

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam 90 min.

[*updated 05.10.2020*]

Applicability / Curricular relevance:

DFBI-346 (P610-0203) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018 , semester 6, optional course, informatics specific
KI656 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-FFKC (P222-0115) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-FFKC (P222-0115) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
MST.FKC (P231-0131) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , optional course, technical
MST.FKC (P231-0131) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , optional course, technical
MST.FKC (P231-0131) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course, technical
PIBWI56 (P221-0109) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-FFKC (P221-0109) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-FFKC (P221-0109) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific
MST.FKC (P231-0131) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , optional course, technical

Workload:

30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Math. Wolfgang Braun

Lecturer: Dipl.-Math. Wolfgang Braun

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will have a basic understanding of the importance and problems of error identification and correction. In addition, they will:
- be able to explain basic terms (redundancy, code rate, generator matrix, check matrix, Hamming distance, Hamming limit, _)
- have mastered arithmetics in finite fields of the type GF (p)
- Coding and decoding of linear binary block codes: have an understanding of the theoretical interrelationships
  and have mastered execution by means of matrix calculation
- be able to construct Hamming codes
- be able to classify binary block codes according to their performance capability
- Coding and decoding of cyclic codes via GF (2): have an understanding of the theoretical interrelationships
  and have mastered execution by means of polynomial operations
- have knowledge of coding theory applications in various fields
- be able to implement basic algorithms from the lecture in a common programming language
- have gained insights into how the coding theory can be developed further
- have learned how mathematical theories can be translated into practice-relevant algorithms in computer science

[*updated 06.09.2018*]

Module content:
- Principle of coding a message for error identification and error correction
- Simple error identification and correction procedures (ISBN No., EAN code, repeat code, 2-dimensional parity, _.)
- The ring of integers, residue classes
- Computations in finite fields GF (p)
- n-dimensional vector spaces over GF (p)
- Linear block codes over GF (2)
- Hamming codes
- Cyclic codes over GF (2)
- Applications and perspectives (ECC-RAM, CRC-32, CIRC, digital TV,
  matrix codes, extension of coding theory by GF (2^n), convolutional codes, _.)

The lecture will concentrate on the algebraic methods. A statistical treatment of the transmission channel (e.g. _Entropy_, _Markov sources_), as well as an implementation of the algorithms by means of hardware

are not part of this lecture.

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture with integrated exercises using a script, demonstration of basic algorithms using Maple.

[*updated 19.02.2018*]

Recommended or required reading:
Lecture script with exercises
Werner, M.: Information und Codierung, vieweg, Braunschweig/Wiesbaden 2002
Klimant, H. u.a. : Informations- und Kodierungstheorie, Teubner, Wiesbaden 2006
Schulz, R.-H. : Codierungstheorie, vieweg, Wiesbaden 2003

[*updated 19.02.2018*]

French for Beginners I

Module name (EN): French for Beginners I

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FFA1

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written examination (final exam)

[*updated 26.02.2018*]

Applicability / Curricular relevance:

E2422 (P200-0011) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, general subject
KI659 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, non-technical
KIB-FFA1 (P200-0011) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, non-technical

KIB-FFA1 (P200-0011) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, non-technical
MAB.4.2.1.6 (P200-0011) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course
MST.FA1 (P200-0011) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 5, optional course, non-technical
MST.FA1 (P200-0011) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 5, optional course, non-technical
MST.FA1 (P200-0011) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 5, optional course, non-technical
PIBWN40 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-FFA1 (P200-0011) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, not informatics specific
PIB-FFA1 (P200-0011) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific
MST.FA1 (P200-0011) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 5, optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The course French for Beginners I is aimed towards learners with little or no previous knowledge of the French language. The courses French for Beginners I and II are based on each other. In the course of the two modules, students will first reach proficiency level A1 and then advance to level A2 of the European Framework of Reference for Languages.

The goal of the course is to provide students with basic knowledge of the French language, which will enable them to communicate in general and professional situations as quickly as possible, both orally and in writing. To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally. Content development will be supported by the repetition of the relevant grammatical structures.

The course takes a communicative and pragmatic approach that particularly promotes communicative competence in job-relevant situations through the use of role playing and situational dialogues. This also includes intercultural aspects that raise the students´ awareness of cultural differences and enable them to assert themselves in specific situations.

[*updated 26.02.2018*]

Module content:
Establishing contact
- Greetings
- Introducing oneself and others
- Asking how someone is feeling
- Giving information about yourself and requesting information about others
- Saying thank you, apologizing and saying goodbye

Job profiles and the workplace
- Company structure and workflow
- Describing jobs and activities
- Showing and describing products

Telephone communication
- Common verbal expressions
- Asking for and giving information

In addition, we will concentrate on basic grammatical structures. Students should work on and expand their basic vocabulary independently.

[*updated 26.02.2018*]

Recommended or required reading:
The course is based on the following textbook and will be supplemented by suitable material from other textbooks:

Jambon, Krystelle: Voyages 1 - Französisch für Erwachsene, Klett, Stuttgart: 2006.

We also recommend purchasing the following grammar exercise book: Eurocentres Paris (group of authors): Exercices de grammaire en contexte - niveau débutant, Hachette Livre, Paris: 2000, 144 p.

Students will receive a list of recommended teaching and learning materials. We recommend the following multimedia learning program for independent learning: Oberstufe Französisch. 6000 Vokabeln zu allen Themen. Vokabellernprogramm auf CD-ROM mit Sprachausgabe. Klett-Verlag, Stuttgart

[*updated 26.02.2018*]

French for Beginners II

Module name (EN): French for Beginners II

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FFA2

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written examination (final exam)

[*updated 26.02.2018*]

Applicability / Curricular relevance:

E2423 (P200-0012, P420-0461) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, non-technical
KI660 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-FFA2 (P200-0012) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-FFA2 (P200-0012) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.7 (P200-0012) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course
MST.FA2 (P200-0012) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course, non-technical
MST.FA2 (P200-0012) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course, non-technical
MST.FA2 (P200-0012) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course, non-technical
PIBWN41 (P200-0012) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-FFA2 (P200-0012) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, not informatics specific
PIB-FFA2 (P200-0012) Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, not informatics specific
MST.FA2 (P200-0012) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 6, optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The courses French for Beginners I and II are based on each other. In the course of the two modules, students will first reach proficiency level A1 and then advance to level A2 of the European Framework of Reference for Languages. The goal of the course is to provide students with basic knowledge of the French language, which will enable them to communicate in general and professional situations as quickly as possible, both orally and in writing.

To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally. Content development will be supported by the repetition of the relevant grammatical structures. The course takes a communicative and pragmatic approach that particularly promotes communicative competence in job-relevant situations through the use of role playing and situational dialogues.

This also includes intercultural aspects that raise the students´ awareness of cultural differences and enable them to assert themselves in specific situations.

[*updated 26.02.2018*]

Module content:
Job profiles and the workplace
- Addresses and telephone numbers
- Work routine: working hours, breaks
- Internal communication: giving information
- Accepting and rejecting suggestions
- Invitations and business lunches
- Business trips

Telephone communication
- Asking for and giving information
- Spelling things
- Making reservations
- Making appointments with date and time

Directions
- Asking for directions
- Giving directions
- Location details

In addition, we will concentrate on basic grammatical structures. Students should work on and expand their basic vocabulary independently.

[*updated 26.02.2018*]

Recommended or required reading:
The course is based on the following textbook and will be supplemented by suitable material from other textbooks:

Jambon, Krystelle: Voyages 1 - Französisch für Erwachsene, Klett, Stuttgart: 2006.

We also recommend purchasing the following grammar exercise book: Eurocentres Paris (group of authors): Exercices de grammaire en contexte - niveau débutant, Hachette Livre, Paris: 2000, 144 p.

Students will receive a list of recommended teaching and learning materials.

We recommend the following multimedia learning program for independent learning: Oberstufe Französisch. 6000 Vokabeln zu allen Themen. Vokabellernprogramm auf CD-ROM mit Sprachausgabe.

Klett-Verlag, Stuttgart

[*updated 26.02.2018*]

French I

Module name (EN): French I

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FRA1

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written examination (final exam)

[*updated 19.02.2018*]

Applicability / Curricular relevance:

E2520 (P200-0026) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, non-technical
E2842 (P211-0298) Electrical Engineering and Information Technology, Master, ASPO 01.04.2019 , optional course, general subject, course inactive since 30.03.2021
KI657 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, non-technical
KIB-FRA1 (P200-0026) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, non-technical
KIB-FRA1 (P200-0026) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, non-technical
MAB.4.2.1.16 (P200-0026) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course
MST.FR1 (P200-0026) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 5, optional course
MST.FR1 (P200-0026) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 5, optional course
MST.FR1 (P200-0026) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 5, optional course
PIBWN35 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-FRA1 (P200-0026) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, not

informatics specific
PIB-FRA1 (P200-0026) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific
MST.FR1 (P200-0026) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 5, optional course

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The courses French I and II are based on each other. In the course of the two modules, students will improve their professional French so that they advance from the desired entry level B1 to level B2 of the Common European Framework of Reference for Languages.

Based on a common level of knowledge and motivation amongst the students, the main objective of the language course is to refresh and develop existing French skills, as well as to reduce barriers to learning and negative attitudes towards language learning while strengthening confidence in one´s own foreign language competence. Subjects and situations that are relevant for the later professional career will be used to impart skills and knowledge that will enable students to communicate orally and in writing with colleagues and business partners in francophone countries.

To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally using, in part, multimedia learning tools. Content development will be supported by the repetition of a basic vocabulary and the relevant grammatical structures, also in self-study.

The course takes a communicative and pragmatic approach that particularly promotes communicative competence in job-relevant situations through the use of role playing and situational dialogues. This also includes intercultural aspects that raise the students´ awareness of cultural differences and enable them to assert themselves in specific situations.

[*updated 24.02.2018*]

Module content:
Establishing contact
- Greetings
- Introducing oneself and others
- Receiving someone
- Presenting a company

Job profiles and the workplace

- Company-internal communication:
- Describing professional activities and priorities
- Company structure and workflow
- Raising one´s own concerns
- Negotiating proposals

Written communication
- Formal aspects (correct form of a letter, layout etc.)
- Formulating a letter of inquiry
- Formulas for greetings and closings, taking into account different stylistic levels

In addition, we will concentrate on basic grammatical structures. Students are expected to work on and expand their basic vocabulary independently in self-learning phases in the multimedia computer language laboratory.

[*updated 05.10.2020*]

Teaching methods/Media:
Teaching and learning materials (print media, slides, audio-visual teaching materials), multimedia learning software specially compiled for the learning group.

[*updated 19.02.2018*]

Recommended or required reading:
- PONS Kompaktwörterbuch für alle Fälle - Französisch-Deutsch/Deutsch-Französisch. Vollständige Neubearbeitung 2002, Klett-Verlag, Stuttgart, ISBN 3-12-517209-8

- M. Grégoire, O. Thiévenaz: Grammaire Progressive du Français - Niveau intermédiaire. (Deutsche Ausgabe); Klett-Verlag, Stuttgart, ISBN 3-12-529873-3

Students will receive a list of recommended teaching and learning materials.

We recommend the following multimedia learning program for independent learning:
Oberstufe Französisch. 6000 Vokabeln zu allen Themen. Vokabellernprogramm auf CD-ROM mit Sprachausgabe. Klett-Verlag, Stuttgart

[*updated 19.02.2018*]

French II

Module name (EN): French II

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FRA2

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written examination (final exam)

[*updated 19.02.2018*]

Applicability / Curricular relevance:

EE-K2-523 (P241-0295) Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012 , semester 6, optional course
EE-K2-523 (P241-0295) Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015 , semester 6, optional course, course inactive since 14.03.2018
E2521 (P241-0295) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, general subject
KI658 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-FRA2 (P241-0295) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-FRA2 (P241-0295) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.17 (P241-0295) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course
MST.FR2 (P241-0295) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course
MST.FR2 (P241-0295) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course
MST.FR2 (P241-0295) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course
PIBWN36 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-FRA2 (P241-0295) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, not informatics specific
PIB-FRA2 (P241-0295) Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, not informatics specific
MST.FR2 (P241-0295) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 6, optional course

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The courses French 1 and 2 are based on each other. In the course of the two modules, students will improve their professional French so that they advance from the desired entry level B1 to level B2 of the Common European Framework of Reference for Languages.
Based on a common level of knowledge and motivation amongst the students, the main objective of the language course is to refresh and develop existing French skills, as well as to reduce barriers to learning and negative attitudes towards language learning while strengthening confidence in one´s own foreign language competence.

Subjects and situations that are relevant for the later professional career will be used to impart skills and knowledge that will enable students to communicate orally and in writing with colleagues and business partners in francophone countries.

To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally using, in part, multimedia learning tools.

Content development will be supported by the repetition of a basic vocabulary and the relevant grammatical structures, also in self-study.

The course takes a communicative and pragmatic approach that particularly promotes communicative competence in job-relevant situations through the use of role playing and situational dialogues.

This also includes intercultural aspects that raise the students´ awareness of cultural differences and enable them to assert themselves in specific situations.

Talking on the telephone

[*updated 05.10.2020*]

Module content:

- Common verbal expressions
- Giving information
- Asking for information
- Arranging and postponing appointments

Job market and job search
- Job advertisements

- Applicant´s profile
- Hiring personnel

Application process
- Resume
- Application cover letter
- Job interview
- Working conditions

In addition, we will concentrate on basic grammatical structures. Students are expected to work on and expand their basic vocabulary independently in self-learning phases in the multimedia computer language laboratory.

[*updated 05.10.2020*]

Teaching methods/Media:
Teaching and learning materials (print media, slides, audio-visual teaching materials), multimedia learning software compiled specifically for the learning group.

[*updated 19.02.2018*]

Recommended or required reading:
- PONS Kompaktwörterbuch für alle Fälle - Französisch-Deutsch/Deutsch-Französisch. Vollständige Neubearbeitung 2002, Klett-Verlag, Stuttgart, 3-12-517209-8
- M. Grégoire, O. Thiévenaz: Grammaire Progressive du Français - Niveau intermédiaire. (Deutsche Ausgabe); Klett-Verlag, Stuttgart, ISBN 3-12-529873-3

Students will receive a list of recommended teaching and learning materials.

We recommend the following multimedia learning program for independent learning:
Oberstufe Französisch. 6000 Vokabeln zu allen Themen. Vokabellernprogramm auf CD-ROM mit Sprachausgabe. Klett-Verlag, Stuttgart

[*updated 19.02.2018*]

Functional Programming

Module name (EN): Functional Programming

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FPRG

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

KI571 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-FPRG Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-FPRG Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI14 (P221-0112) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-FPRG (P221-0112) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-FPRG (P221-0112) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Thomas Kretschmer

Lecturer: Prof. Dr. Thomas Kretschmer

[*updated 13.01.2026*]

Learning outcomes:

[*still undocumented*]

Module content:

[*still undocumented*]

Recommended or required reading:

[*still undocumented*]

Future Internet and Smart City with Software Defined Networking

Module name (EN): Future Internet and Smart City with Software Defined Networking

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FISC

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 26.04.2021*]

Applicability / Curricular relevance:

E2543 (P221-0064) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , semester 5, optional course, technical, course inactive since 14.09.2020
KIB-FISC (P221-0064) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-FISC (P221-0064) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
MST.FSC (P221-0064) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 5, optional course
PIB-FISC (P221-0064) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-FISC (P221-0064) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).

There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Joberto Martins

Lecturer: Prof. Joberto Martins

[*updated 13.01.2026*]

Learning outcomes:
Internet and networks are evolving and expanding their utilization dramatically.

The students will be able to explain new paradigms, new protocols, new intelligent solutions and large scale complex systems and apply these concepts to various areas of our daily life. They understand the current network evolution trends and know the relevant new technologies involved.

The students are able to analyze the network evolution scenario and apply the new SDN/OpenFlow ideas in the context of the actual and challenging Smart City scenario. They can distinguish certain development challenges with respect to Smart City characteristics, furthermore solve project issues by establishing underlying concepts. They use SDN/OpenFlow architecture and apply basic Machine Learning tools to Smart City project issues.

[*updated 26.04.2021*]

Module content:
1) Evolutionary Networking Architecture approaches and SDN
- Networking evolution scenario
- Software-Defined Networking (SDN)
- Networks evolutionary architectural issues: virtualization, cognitive management, autonomy, naming, addressing, mobility, scalability
- SDN standardization

2) SDN/ OpenFlow Protocol Ecosystem

- OpenFlow (OF) Architecture and EcoSystem
- OpenFlow and Virtualization
- OpenFlow Protocol Messages and Flow Diagram
- OpenFlow Use Cases: virtual router, level 2 virtualization, other
- OpenFlow hands on with MiniNet
  * MiniNet and basic OpenFlow operation
  * Virtualization with FlowVisor

3) Smart City Project - Characteristics, Requirements and Solutions

- Smart City Definition, Characteristics and Requirements
- Smart City Framework
- Smart City - Use Cases

4) Smart City Project Use Case

- Smart City model for network communication
- Data and Internet of Things (IoT) in Smart Cities
- Cognitive Management with Machine Learning (ML)
- Other Smart City technological approaches

[*updated 26.04.2021*]

Recommended or required reading:
[1] F. Theoleyre, T. Watteyne, G. Bianchi, G. Tuna, V. Cagri Gungor, and Ai-Chun Pang. Networking and Communications for Smart Cities Special Issue Editorial. Computer Communications, 58:1 3, March 2015.
[2] R. Bezerra, F. Maristela, and Joberto Martins. On Computational Infraestruture Requirements to Smart and
Autonomic Cities Framework. In IEEE Int. Smart Cities Conference - ISC2-2015, pages 1 6. IEEE, January 2015.
[3] Joberto S. B. Martins. Towards Smart City Innovation Under the Perspective of Software-Defined Networking,
Artificial Intelligence and Big Data. Revista de Tecnologia da Informação e Comunicação, 8(2):1 7, October 2018.
[4] D. Kreutz, F. M. V. Ramos, P. E. Veríssimo, C. E. Rothenberg, S. Azodolmolky, and S. Uhlig. Software-Defined
Networking: A Comprehensive Survey. Proceedings of the IEEE, 103(1):14 76, January 2015.
[5] Subharthi Paul, Jianli Pan, and Raj Jain. Architectures for the Future Networks and the Next Generation Internet: A Survey. Computer Communications, 34(1):2 42, January 2011.
[6] A. Gharaibeh, M. A. Salahuddin, S. J. Hussini, A. Khreishah, I. Khalil, M. Guizani, and A. Al-Fuqaha. Smart
Cities: A Survey on Data Management, Security, and Enabling Technologies. IEEE Communications Surveys
Tutorials, 19(4):2456 2501, 2017.
[7] R. Jalali, K. El-khatib, and C. McGregor. Smart City Architecture for Community Level Services Through the
Internet of Things. In 2015 18th Int. Conf. on Intel. in Next Generation Networks, pages 108 113, February 2015.

[*updated 26.04.2021*]

Future Internet: Software Defined Networking

Module name (EN): Future Internet: Software Defined Networking

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-FSDN

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
4

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam/paper

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI596 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-FSDN Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-FSDN Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI44 (P221-0076) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-FSDN Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-FSDN Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to classify all of the consequences of adopting Software Defined Networking (SDN) to the applications development process. Students will be able to assess the impact of SDN for the TCP/IP architecture. They will also be capable of explaining and implementing openflow-based applications. In addition, students will be capable of designing control and monitoring frameworks and writing a concept for a deploying mechanism of such tools using advanced concepts such as federation.

[*updated 26.02.2018*]

Module content:
1. Networking Architectural Approaches and Issues:

- Actual IP architecture scenario and new requirements
- Software Defined Networking (SDN)
- Architectural issues: naming, addressing, mobility, scalability, autonomy and virtualization

2. OpenFlow Protocol:
- OpenFlow (OF) architecture
- OF protocol
- OF and virtualization
- OF use cases: virtual router, level 2 virtualization, other
- OF experimentation with MiniNet (hands-on exercises)

3. Experimental Networks (EN):
- Experimental Networks principles - user-defined, large and innovative experiments, users, reproducibility, scaling and monitoring:
  . Experiment (project) requirements
  . Experiment (project) planning
  . Experiment (project) execution
  . Experiment (project) monitoring
- CMF - Control and Monitoring Framework - model and components
- Experimental network OFELIA (OpenFlow in Europe: Linking Infrastructure and Applications) _ Architecture:
 components, tools, experimentation facilities, monitoring
- Experimental Network OMF (Orbit Management Framework) _ Architecture:
components, tools, experimentation facilities, monitoring
- Experimental Network FIBRE EU-BR (Future Internet Testbed Experimentation between Brazil and Europe) _ Architecture:
components, tools, experimentation facilities, monitoring
- Experimental networks monitoring:
- Architecture, components and issues on monitoring an experiment using an "Experimental Network" (EN)

- Study case: FIBRE EU-BR I&M Architecture
- Experimental Networks Federation:
  . Federation principles
  . SFA (Slice-based Federation Architecture) approach
- Experimental Networks "hands-on" exercise:
  Exercise: create a project/experiment on one of the above experimental networks (OFELIA, OMF or FIBRE)

4. Future Internet - Trends and Scenarios:
- QoS (Quality of Service) and QoE (Quality of Experience) in FI
- FI use cases
- FI research

[*updated 26.02.2018*]

Recommended or required reading:

[*still undocumented*]

Game Design

Module name (EN): Game Design

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-GAD

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Project work with composition and final presentation

[*updated 30.04.2025*]

Applicability / Curricular relevance:

KIB-GAD (P222-0135) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-GAD (P222-0135) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-GAD (P222-0135) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Maximilian Altmeyer

Lecturer: Prof. Dr. Maximilian Altmeyer

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to conceptualize their own game and

describe the game mechanics in a game design document. They will be able to organize a project based on the example of game development and lay the foundation for implementing a game.

[*updated 30.04.2025*]

Module content:
- What are games and why do people play?
- Brainstorming techniques
- Telling interactive stories
- Developing characters
- Game mechanics
- Designing levels
- Designing puzzles
- Game design document
- Analyzing the game mechanics in different types of games
- Physics in games
- Resource management and game economies
- Gamification

[*updated 30.04.2025*]

Recommended or required reading:

[*updated 30.04.2025*]

Game Design and Development

Module name (EN): Game Design and Development

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-GDEV

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: according to optional course list

Mandatory course: no

Language of instruction:
English

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI598 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-GDEV (P221-0077) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course, technical
KIB-GDEV (P221-0077) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, technical
PIBWI43 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-GDEV (P221-0077) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, informatics specific
PIB-GDEV (P221-0077) Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. André Miede

Lecturer: Prof. Dr.-Ing. André Miede

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to apply their programming, algorithmic/mathematical, and project management skills
for solving basic problems during the design and development of computer games.

[*updated 26.02.2018*]

Module content:
The course introduces the basic concepts and challenges of designing and developing computer games. The focus is mainly on technical aspects such as understanding typical algorithms (and their underlying mathematical concepts) and implementing them using typical programming languages. In addition, state-of-the-art game technologies, i.e., game engines, can be used for the project(s).
1. Introduction and Overview
2. Game Production/Processes and Teams
3. Game Design
4. Game Architecture

5. Collision Detection
6. Computer Graphics
7. Artificial Intelligence
8. Selected Special Topics from the Field of Game Development

[*updated 26.02.2018*]

Recommended or required reading:
Main references:
Game Design and Development
Clinton Keith: Agile Game Development with SCRUM, 2010
Steve Rabin: Introduction to Game Development, 2010
Jeannie Novak: Game Development Essentials: An Introduction, 2011
Game Design
Scott Rogers: Level Up! The Guide to Great Video Game Design, 2014
Jesse Schell: Die Kunst des Game Designs, 2012
Ernest Adams: Fundamentals of Game Design, 2009

Suggested further reading:
Will Goldstone: Unity 3.x Game Development Essentials, 2011, ISBN-13: 978-1849691444
Penny Baillie-De Byl: Holistic Game Development with Unity: An All-In-One Guide to Implementing Game Mechanics, Art, Design, and Programming, 2011, ISBN-13: 978-0240819334
Chris Crawford: The Art of Computer Game Design
Ulrich Schmidt: Game Design und Produktion: Grundlagen, Anwendungen und Beispiele
Katie Salen, Eric Zimmermann: Rules of Play: Game Design Fundamentals, 2003, ISBN-13: 978-0262240451

[*updated 26.02.2018*]

GUI Programming with Qt

Module name (EN): GUI Programming with Qt

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-PRQT

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: according to optional course list

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI603 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , optional course, informatics specific
KIB-PRQT (P222-0116) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course, technical
KIB-PRQT (P222-0116) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, technical
PIBWI63 Applied Informatics, Bachelor, ASPO 01.10.2011 , optional course, informatics specific
PIB-PRQT (P221-0079, P222-0116) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-PRQT (P221-0079, P222-0116) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Hong-Phuc Bui, M.Sc.

Lecturer: Hong-Phuc Bui, M.Sc.

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will have mastered the three components of the Qt framework: Qt widget, QML/QtQuick and the input/output framework. They will be able to use these components to develop desktop applications with a graphical user interface and access to common data sources (file system, database, http web service).
In addition, they will demonstrate and deepen the knowledge they have acquired in this subject area in a project.

[*updated 26.02.2018*]

Module content:
1. Qt Widget and QML/QtQuick
   * Common C++-based GUI widgets
   * Designing graphical user interfaces with the declarative language QML
2. The signal and slot concept, the elementary concept in Qt to connect Qt objects
3. In and output utilities in Qt libraries
   * Access to the file system, database and http website

* Graphical representation of data
4. Working with the IDE Qt Creator and
the build program qmake, syntax of a qmake file.

[*updated 26.02.2018*]

Recommended or required reading:
* qt.io: Qt Documentation (http://doc.qt.io/)
* Qt Project Documentation (http://qt-project.org/doc/)
* Guillaume Lazar, Robin Penea: Mastering Qt 5, 2016

[*updated 26.02.2018*]

Human Computer Interaction

Module name (EN): Human Computer Interaction

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-HCI

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI636 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-HCI (P221-0062) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-HCI (P221-0062) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
KI855 Computer Science and Communication Systems, Master, ASPO 01.04.2016 , semester 2, optional course, course inactive since 30.09.2009
MAM.2.1.2.20 (P221-0062) Engineering and Management, Master, ASPO 01.10.2013 , semester 1, optional course, specialisation
PIBWI90 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific

PIB-HCI (P221-0062) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-HCI (P221-0062) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Steven Frysinger

Lecturer: Prof. Steven Frysinger

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to:
- Discuss the cognitive characteristics of humans involved in computing and information systems;
- Analyze information systems to assess their ability to meet user needs;
- Identify and characterize the users of a particular information system to be designed;
- Gather and analyze needs assessment data from representative users of an information system;
- Develop a hierarchical task analysis of the users;
- Develop both a conceptual design and a physical design for an information system;
- Write a user requirements specification for the system;
- Develop a test plan by which their system design could be submitted to summative evaluation upon implementation.

Computer systems are embedded in virtually every aspect of our modern life, from the database systems that help us run our businesses to the cellular telephones we have come to depend on for daily personal communication. However, developers of these tools frequently forget that the human being is part of the computer system, because essentially all of these systems depend on human interaction of some sort to produce the desired end result. In order to overcome this, we must educate computer system developers about the nature of the human/computer interface (HCI) and give them tools with which to design and test effective interfaces in the systems they develop.

This course will:

(A) make the system developer aware of the human aspects of the system, including the cognitive and perceptual attributes of the human being;

(B) provide the developer with design criteria and guidelines that will help produce effective interactive computer systems; and

(C) teach the developer how to quantitatively test the human/computer interface in a rigorous way

[*updated 26.02.2018*]

Module content:
1. Interactive Computer Systems, Human Factors Engineering, and the Software Engineering Lifecycle
2. Process of interaction design: User-centered design
3. Needs assessment and requirements specification
4. Conceptual design
5. Physical design: Graphical user interfaces
6. Widget design: When to use what
7. Test phase: Evaluation
8. Understanding users: Cognition, sensation & perception, mental models, and the differently-abled"
9. Decision support
10. Data representation
11. Help and documentation; Multimedia and the World Wide Web

[*updated 14.05.2025*]

Recommended or required reading:
Interaction Design (second edition). Jennifer Preece, Yvonne Rogers, Helen Sharp, John Wiley and Sons, 2007.

[*updated 26.02.2018*]

Industrial Development Processes

Module name (EN): Industrial Development Processes

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-IEP

Hours per semester week / Teaching method:
3V+1U (4 hours per week)

ECTS credits:
5

Semester: 4

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 28.09.2023*]

Applicability / Curricular relevance:

KIB-IEP (P212-0090) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, optional course
KIB-IEP (P212-0090) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, optional course
MST.IEP (P212-0090) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course
PIB-IEP (P212-0090) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-IEP (P212-0090) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Kai Haake

Lecturer: Prof. Dr. Kai Haake

[*updated 13.01.2026*]

Learning outcomes:
The course is specifically designed for students who anticipate the need for project management skills in their future career.
After successfully completing this part of the module, students will be familiar with the most important fundamentals of business administration and project management. This course is not intended as a pure project management course, but rather an introduction for engineering students to business issues to help them deal with standard tasks, optimization procedures and analysis methods. The course will also help students understand future project partners with a business background by for example, teaching them practical jargon.
On the basis of practical industrial development projects, students will acquire knowledge about costs, procurement and marketing/sales in particular. Complementary topics such as business administration and industrial development processes will expand students´ understanding of economic and corporate strategy perspectives and methods. Students will be able to understand product development plans and create large parts of them on their own.

[*updated 26.01.2023*]

Module content:
- Utility theory
- Market economy theory and price theory
- Cost and production theory
- Finance theory
- Decision theory
- Project management

- Marketing
- External cooperations
- Business case & co.

[*updated 26.01.2023*]

Teaching methods/Media:
The lecture integrates exercises and seminar-based instruction on selected topics.

[*updated 26.01.2023*]

Recommended or required reading:
Plinke, Wulff, Mario Rese, und B. Peter Utzig. Industrielle Kostenrechnung. 8. Auflage. Berlin Heidelberg: Springer Vieweg, 2015
Peters, Theo, und Nicole Schelter. Kompakte Einführung in Das Projektmanagement. 1st ed. 2021. Wiesbaden: Springer Fachmedien Wiesbaden, 2021
Breyer, Friedrich. Mikroökonomik. 6., überarb. u. aktual. Aufl. Berlin [u.a.]: Springer Gabler, 2015
Simon, Hermann, und Martin Faßnacht. Preismanagement. 4., vollständig neu bearbeitete und erweiterte Auflage. Wiesbaden: Springer Gabler, 2016
Backhaus, Klaus, Bernd Erichson, Wulff Plinke, und Rolf Weiber. Multivariate Analysemethoden. 15., vollständig überarbeitete Auflage. Berlin, Heidelberg: Springer Gabler, 2018

[*updated 26.01.2023*]

Industrial Ecology

Module name (EN): Industrial Ecology

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-INEC

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
English

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI671 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-INEC (P241-0162) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-INEC (P241-0162) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.6.4 (P241-0162) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course, non-technical
PIBWN11 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-INEC (P241-0162) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-INEC (P241-0162) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Steven Frysinger

Lecturer: Prof. Steven Frysinger

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to:
- Define environmental science and describe the key environmental challenges presented by industrial society;
- Define industrial ecology and explain the metaphorical relationship between industrial systems and biological ecosystems;
- Interpret the _master equation_ of industrial ecology and explain the role of technology in the pursuit of a more sustainable industrial society;
- Define and give examples of the concepts of Design for Environment and Environmentally Conscious Manufacturing;
- Provide a detailed explanation of the Life Cycle Assessment methodology and carry out such an assessment on a product/system;
- Discuss allocation of environmental loads to system components;
- Interpret the role of Life Cycle Assessment in environmental management decision-making.

[*updated 26.02.2018*]

Module content:
We will study the theoretical underpinnings of IE, briefly examining the biological metaphor for industrial ecosystems. We will also address various elements of practice which are associated with IE, especially Life Cycle Assessment and Design for Environment. Our goal is to better understand how industrial ecology can help us to evolve into a sustainable industrial society.

[*updated 26.02.2018*]

Recommended or required reading:
GRAEDEL, T. E./ B. R. ALLENBY, B.R.: Industrial Ecology. Prentice Hall, 2003.

[*updated 26.02.2018*]

Information Retrieval

Module name (EN): Information Retrieval

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-IRET

Hours per semester week / Teaching method:
2V+2PA (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
English

Assessment:
Written exam, duration 90 min./project work

[*updated 13.10.2024*]

Applicability / Curricular relevance:

DFIW-IRET (P610-0540) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 3, mandatory course, informatics specific
KI584 (P610-0253) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, informatics specific
KIB-IRET Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-IRET Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI29 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific

PIB-IRET (P221-0080) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-IRET (P221-0080) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Klaus Berberich

Lecturer: Prof. Dr. Klaus Berberich

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will have learned basic information retrieval methods. This
includes retrieval models (e.g., Vector Space Model and Binary Independence Model), link analysis (e.g., PageRank), and effectiveness measures (e.g., Precision/Recall
and MAP). They will be able to apply/implement the above methods in practice. In addition, students will be aware of easily accessible information retrieval systems (e.g., Apache Lucene/Solr).

[*updated 13.10.2024*]

Module content:
Information Retrieval is pervasive and its applications range from finding contacts or e-mails on your smartphone to web-search engines that index billions of web pages. This course covers the most important information retrieval methods. We will look into how these methods are defined formally, including the mathematics behind them, but also see how they can be implemented efficiently in practice. As part of the project work, we will implement a small search engine from scratch.

1. Introduction
- History
- Applications
- Course overview

2. Natural language
- Documents and terms
- Stopwords and stemming/lemmatization

- Synonyms, polysemes, compounds

3. Retrieval models
- Boolean retrieval
- Vector space model with TF.IDF term weighting
- Language models

4. Indexing methods
- Inverted index
- Compression (d-Gaps, variable-byte encoding)
- Index pruning

5. Query processing
- Holistic methods (DAAT, TAAT)
- Top-k methods (NRA, WAND)

6. Evaluation
- Cranfield Paradigm
- Benchmark initiatives (TREC, CLEF, NTCIR)
- Traditional effectiveness measures (precision, recall, MAP)
- Non-traditional effectiveness measures (nDCG, ERR)

7. Web retrieval
- Crawling
- Near-duplicate detection
- Link analysis (PageRank, HITS)
- Web spam

8. Information retrieval systems
- Indri
- Terrier
- Anserini
- Apache Lucene/Solr
- ElasticSearch

[*updated 13.10.2024*]

Recommended or required reading:

Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack: Information Retrieval: Implementing and Evaluating Search Engines, MIT Press, 2010.

Reginald Ferber: Information Retrieval: Suchmodelle und Data-Mining Verfahren für Textsammlungen und das Web, dpunkt, 2003.
(available online at: http://information-retrieval.de/irb/ir.html)

W. Bruce Croft, T. Strohman, D. Metzler: Search Engines Information Retrieval in Practice: Information Retrieval in Practice, Pearson, 2009
(Available online at: https://ciir.cs.umass.edu/irbook/)

Christopher D. Manning, Prabhakar Ragahavan, and Hinrich Schütze: Introduction to Information Retrieval, Cambridge University Press, 2008.
(Available online at: http://nlp.stanford.edu/IR-book/)

[*updated 13.10.2024*]

Information Security

Module name (EN): Information Security

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ISEC

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Exam

[*updated 08.05.2023*]

Applicability / Curricular relevance:

KI616 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-ISEC (P221-0063) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-ISEC (P221-0063) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI99 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-ISEC (P221-0063) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-ISEC (P221-0063) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 13.01.2026*]

Learning outcomes:
After this module, students will have mastered the essential concepts of information security and be able to assess the importance of information security. They will be familiar with the structure of the IT Baseline Protection Catalogs (IT-Grundschutz Kataloge) and how they are applied.

To do so, they will be familiar with the procedure according to IT-Grundschutz (BSI Standard 100-2) and be able to create an IT security concept based on this procedure. Furthermore, they will know what to take into account when setting up an information security management system and the information security process.

Students will develop skills that enable them to formally identify and assess component security requirements. This includes the process of maintaining and continuously improving information security.

In a practical project, students will use their knowledge to create an IT security concept based on a case study.

[*updated 08.05.2023*]

Module content:
1. Introduction

2. Information security? Why?
   a. History of information security
      i. Timeline
      ii. Caesar cipher, Skytale
      iii. First virus

   b. Data protection and information security
   c. Information technology developments

[*updated 08.05.2023*]

Teaching methods/Media:
Basics of information security in theoretical-conceptual discussion

Practical project (creation of an IT security concept based on a case study)

[*updated 08.05.2023*]

Recommended or required reading:

[*updated 08.05.2023*]

Intercultural Communication

Module name (EN): Intercultural Communication

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-INTK

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Composition

[*updated 19.02.2018*]

Applicability / Curricular relevance:

BMT1584 Biomedical Engineering, Bachelor, ASPO 01.10.2013 , optional course, non-medical/technical
E1584 (P200-0015) Electrical Engineering, Bachelor, ASPO 01.10.2012 , optional course, non-technical
KI589 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-INTK Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course
KIB-INTK Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course
MAB.4.2.1.27 (P200-0015) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 4, optional course, non-technical
PIBWN67 (P200-0015) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-INTK Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course
PIB-INTK Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The main objective of this course is the development of consciousness and reflection on one´s own cultural imprint in thought, action and communication patterns. This awareness is decisive for any successful intercultural cooperation in both professional and private spheres.
We approach other cultures through an idea of culture that influences our perception, thinking and actions. The characteristics and comparable dimensions of cultures on the macro level are in the foreground here. These, in turn, are complemented by a look at the intercultural micro-level that arises in the contact between individuals.
An introduction to the theories and approaches from different disciplines to these questions will enable a better understanding of people from other cultures and is intended to facilitate a change of perspective. This change of perspective is a central starting point for acquiring the following key competences:
- The ability to assess your own personal cultural influence,
- The ability to know, understand and accept backgrounds of foreign/culturally specific behavior,
- The ability to deal with contradiction and ambiguity,
- The ability to behave adequately in an intercultural context and thus, enable effective action.

[*updated 19.02.2018*]

Module content:
1. What is culture? How do cultural differences arise? Stereotypes?
2. Communication and culture _ How does communication work and what role can cultural factors play in it?
3. Verbal and non-verbal communication
4. Acculturation/Culture shock
5. Intercultural communication strategies
6. Diversity management
7. Globalization and its influences on culture and intercultural communication

Case studies and examples will be adapted to the needs of the students.

[*updated 19.02.2018*]

Teaching methods/Media:
Lectures by lecturers and discussion, group work on small case studies, simulation games, films.

[*updated 19.02.2018*]

Recommended or required reading:
R. Gibson: Intercultural Business Communication. Cornelsen & Oxford
F.E. Jandt: An Introduction to Intercultural Communication _ Identities in a Global Community. Sage

M. Mooij: Global Marketing and Advertising. Sage
J.W. Neuliep: Intercultural Communication _ A Contextual Approach. Sage
M. Schugk: Interkulturelle Kommunikation. Verlag Franz Vahlen

[*updated 19.02.2018*]

Internet and the Law

Module name (EN): Internet and the Law

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-REII

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI651 (P221-0061) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, non-technical
KIB-REII (P221-0061) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, non-technical
KIB-REII (P221-0061) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, non-technical
MAB.4.2.7.4 Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course, non-technical
PIBWN60 (P221-0061) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-REII (P221-0061) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, not informatics specific
PIB-REII (P221-0061) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).

There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
RA Cordula Hildebrandt

Lecturer: RA Cordula Hildebrandt

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be familiar with the legal issues that are of significance when creating, maintaining and hosting a website.
They will be able to answer questions pertaining to general topics such as the application of law to the internet, copyright infringement and intellectual property rights, as well as to more advanced topics such as e-commerce, distance selling, concluding contracts via the internet, internet security and data protection and privacy. They will be capable of demonstrating what they have learned using examples and relevant legal judgments.
Students will be able to assess the applicability of the relevant regulations and laws in this area and use this knowledge to clarify new issues.

[*updated 26.02.2018*]

Module content:
1. The website
1.1 Domain name law
   a) Address allocation
   b) Requirements relating to potential infringements of trademark law
1.2 Impressum (site information required under German law)
   a) Mandatory information
   b) Requirements under German employment law
2. Concluding contracts via the Internet
2.1 Formal requirements
2.2 Offer and acceptance
2.3 General terms and conditions
2.4 Appeals
3. Patent and proprietary rights
3.1 Application of law
3.2 Copyright laws
3.3 Trademark law
4. Security
4.1 Electronic signatures
4.2 Watermarks
5. Data protection and privacy

[*updated 26.02.2018*]

Recommended or required reading:
http://www.rechtslexikon-online.de Gesetzestexte

http://www.jurawelt.de/
Navigation bar: Studentenwelt -> Skripten -> A. Zivilrecht

http://www.uni-muenster.de/Jura.itm/hoeren/
Navigation bar: Lehre -> Materialien -> Skriptum Internet-Recht

[*updated 26.02.2018*]

Introduction to Astronomy

Module name (EN): Introduction to Astronomy

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ASTR

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 05.10.2020*]

Applicability / Curricular relevance:

KI674 (P200-0008) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, non-technical
KIB-ASTR (P200-0008) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, non-technical
KIB-ASTR (P200-0008) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, non-technical
MAB.4.2.1.3 (P200-0008) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course
MST.EAS (P200-0008) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 5, optional course, non-technical
MST.EAS (P200-0008) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 5, optional course, non-technical
MST.EAS (P200-0008) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 5, optional course, non-technical

PIBWN25 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-ASTR (P200-0008) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, not informatics specific
PIB-ASTR (P200-0008) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific
MST.EAS (P200-0008) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 5, optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Martin Löffler-Mang

Lecturer: Prof. Dr. Martin Löffler-Mang

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to orient themselves on the night sky, recognize structures and find the most important constellations in the northern sky. In addition, they will be capable of using the most important basic tools for astronomical observations. Students will also be familiar with elementary celestial mechanics and will be able to make simple predictions for the rising and setting of selected celestial bodies. Finally, students will know about the various astronomical objects in the sky and will be familiar with the standard models for both the formation of the universe (Big Bang theory) and its further development (accelerated expansion of the universe).

[*updated 19.02.2018*]

Module content:
Part I: Introduction
1. Where Are We?
2. The Night Sky
3. Observation Tools

Part II: The Solar System
1. The Sun
2. The Moon
3. The Planets
4. Celestial Mechanics

Part III: Astronomical Instruments
1. Large Telescopes
2. Space Telescopes

Part IV: Astrophysics
1. Cosmology
2. The Principles and Terms of Nuclear Physics (Folkerts)
3. Stars, Star Formation, The Origin of Elements (Folkerts)
4. Are We Alone?

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture, observations

[*updated 26.02.2018*]

Recommended or required reading:
Kosmos-Himmelsjahr (almanac)
Sterne und Weltraum (monthly journal)

[*updated 19.02.2018*]

Introduction to Parallel Programming with CUDA

Module name (EN): Introduction to Parallel Programming with CUDA

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-CUDA

Hours per semester week / Teaching method:
1V+1P (2 hours per week)

ECTS credits:
3

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Project work, presentation and composition

[*updated 24.02.2018*]

Applicability / Curricular relevance:

DFBI-342 Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018 , semester 6, optional course, informatics specific
KI593 (P222-0074) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester

5, optional course, technical
KIB-CUDA (P222-0074) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-CUDA (P222-0074) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI39 (P222-0074) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-CUDA Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-CUDA Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Inform. Marion Bohr

Lecturer: Dipl.-Inform. Marion Bohr

[*updated 13.01.2026*]

Learning outcomes:
CUDA (Compute Unified Device Architecture) is a technology developed by NVIDIA that allows software developers and software engineers to use a CUDA-enabled graphics processing unit for general purpose processing.

After successfully completing this module, students will have received insight into problem solving by means of parallel programming. They will understand the algorithmic basics of parallel programming. Students will be capable of using hardware and software components based on CUDA and demonstrate their use by carrying out clearly defined practical exercises. They will be able to leverage the strengths of a GPU architecture in practice-oriented project work, optimize its performance and analyze the resource requirements of a parallel implementation.

[*updated 26.02.2018*]

Module content:
* Basics: processes, threads, blocks, warps, memory types, etc.
* Algorithmic basics
* Examples of algorithms and implementations for programs that can and cannot be parallelized
* Runtime measurement, runtime comparison, possibilities for increasing performance
* GPU applications from different subject areas using the example of CUDA

[*updated 26.02.2018*]

Teaching methods/Media:
Presentation slides, board, exercises

[*updated 26.02.2018*]

Recommended or required reading:
* The CUDA Handbook: A Comprehensive Guide to GPU Programming, Nicholas Wilt, Addison-Wesley 2013
* CUDA by Example _ An Introduction to General-Purpose GPU Programming, Jason Sanders/ Edward Kandrot, Addison-Wesley 2011
* Programming Massively Parallel Processors _ A Hands-on Approach, David B. Kirk/ Wen-mei W. Hwu, Elsevier-Morgan Kaufmann Publishers 2010

[*updated 26.02.2018*]

Introduction to the Basics of Artificial Intelligence

Module name (EN): Introduction to the Basics of Artificial Intelligence

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-GKI

Hours per semester week / Teaching method:
2V+2S (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam, Duration 90 min.

[*updated 05.11.2025*]

Applicability / Curricular relevance:

KIB-GKI (P221-0213) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-GKI (P221-0213) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-GKI (P221-0213) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).

There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Christoph Tholen

Lecturer: Prof. Dr. Christoph Tholen

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to name and distinguish between different subfields of artificial intelligence. They will understand the most important principles and be able to independently implement simple tasks from various subfields. Students will be able to identify suitable artificial intelligence methods and procedures and apply them in simple application scenarios. They will work independently on simple AI systems in small teams. Students will discuss ethical issues associated with the use of AI in detail and take these into account when designing AI systems.

[*updated 05.11.2025*]

Module content:
Historical development of artificial intelligence
Propositional logic
First-order predicate logic
Expert systems
Fuzzy logic
Uninformed and informed searches, heuristics
Supervised and unsupervised machine learning

[*updated 05.11.2025*]

Teaching methods/Media:
Slides, programming exercises in PROLOG, Python, and KNIME

[*updated 05.11.2025*]

Recommended or required reading:
Ertel, W.: Grundkurs Künstliche Intelligenz: Eine praxisorientierte Einführung. Springer Fachmedien, Wiesbaden (2021). https://doi.org/10.1007/978-3-658-32075-1
Frochte, J.: Maschinelles Lernen: Grundlagen und Algorithmen in Python. Hanser, München (2019). https://doi.org/10.3139/9783446459977.
Russell, S.J., Norvig, P.: Künstliche Intelligenz: ein moderner Ansatz. Pearson, München, Germany (2012).
Karatas, M.: Eigene KI-Anwendungen programmieren. Rheinwerk Verlag, Bonn (2024). ISBN 978-3-8362-9763-9
Hopgood, A.A.: Intelligent Systems for Engineers and Scientists: A Practical Guide to Artificial Intelligence. CRC Press, Boca Raton (2021). https://doi.org/10.1201/9781003226277.

[*updated 05.11.2025*]

Introduction to Wireless LANs

Module name (EN): Introduction to Wireless LANs

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-WLAN

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam (90 min.)

[*updated 19.02.2018*]

Applicability / Curricular relevance:

E2428 (P200-0033) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, technical
KI632 (P200-0033) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-WLAN (P200-0033) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-WLAN (P200-0033) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI20 (P200-0033, P610-0199) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-WLAN (P200-0033) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-WLAN (P200-0033) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Math. Wolfgang Braun

Lecturer: Dipl.-Math. Wolfgang Braun

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will have a basic understanding of the terms and relationships required for the use of WLAN in communications technology.
- They will be able to explain the basic concepts of WLAN technologies according to the standard 802.11

- They will be able to use the formulas from telecommunications engineering discussed in the lecture to solve WLAN problems.
- Students will know how to set up secure WLAN environments

- They will be able to explain basic procedures for planning, installing, configuring (functionality, security) and monitoring WLAN systems
- And they will be able to design simple WLAN applications

[*updated 30.07.2021*]

Module content:
- Basic functionality according to the IEEE 802.11 standard
- Typical areas of application and reasons for use
- Basic knowledge about electromagnetic waves (modulation, attenuation, antenna gain, free space path loss,...)
- Practical exercises on the propagation of electromagnetic waves
- Problems with use and negative aspects
- The technologies of the WLAN standard 802.11
- Presentation of a current system with practical experiments
- Security in WLANs
- Planning and monitoring WLANs with a presentation of the software used for this purpose
- Examples of use
- Evaluation criteria for WLAN systems

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture using PowerPoint slides and worksheets. Practical experiments with standard WLAN hardware and home-made antennas.

[*updated 19.02.2018*]

Recommended or required reading:
PowerPoint slides will be available to the students.
Rech, J. : Wireless LANs Heise-Verlag, 4. Auflage, Hannover 2012, ISBN 978-3-936931-75-4
Kauffels, F.-J. : Moderne Wireless-Technologien, Technologiereport der Firma ComConsult, 2012

[*updated 19.02.2018*]

IT Forensics

Module name (EN): IT Forensics

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ITF

Hours per semester week / Teaching method:
1V+1P (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Successful participation in the tutorial, oral examination

[*updated 26.02.2018*]

Applicability / Curricular relevance:

DFBI-344 (P610-0200) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018 , semester 6, optional course, informatics specific
KI690 (P221-0083) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-ITF Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-ITF Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI54 (P221-0083) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-ITF Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-ITF Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific
PRI-ITF Production Informatics, Bachelor, SO 01.10.2023 , semester 5, optional course, informatics specific
PRI-ITF Production Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to use the system properties of an IT system to secure evidence that can be used in court after an IT security incident. To this end, they will apply best practices, compare the advantages and disadvantages, isolate problems that arise and investigate the usability of the secured data. They will be capable of interpreting the collected data and presenting the results convincingly to an independent authority.

[*updated 26.02.2018*]

Module content:
1. General information about the field
   Tools
   Literature

2. Introduction
   Definition of terms
   Motivation for authorities
   Motivation for companies

3. Principles of IT forensics
   Procedure model
   Digital traces
   Volatile data
   Interpreting data
   Interpreting time stamps

4. File system basics
   Hard disks, partitioning, file systems
   Unix file management

5. File system analysis
   Creating a file system image
   Analyzing a file system image
   Deleted files
   File carving

6. Analyzing a compromised system
   Process handling
   RAM
   Rootkits

[*updated 26.02.2018*]

Recommended or required reading:
Forensic Discovery. (Addison-Wesley Professional Computing) (hard cover)
by Daniel Farmer (author), Wietse Venema (author)

http://www.amazon.de/Forensic-Discovery-Addison-Wesley-Professional-Computing/dp/020163497X

File System Forensic Analysis. (soft cover) by Brian Carrier (author)
http://www.amazon.de/System-Forensic-Analysis-Brian-Carrier/dp/0321268172

[*updated 26.02.2018*]

IT Forensics Practical Course

Module name (EN): IT Forensics Practical Course

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ITFP

Hours per semester week / Teaching method:
2P (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI601 (P221-0084) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , optional course, technical
KIB-ITFP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-ITFP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI66 (P221-0084) Applied Informatics, Bachelor, ASPO 01.10.2011 , optional course, informatics specific
PIB-ITFP Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-ITFP Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to secure justiciable evidence in the event of an IT security incident. In particular, they will be capable of tracing manipulative operations at the operating system level. This will enable them to uncover digital traces of electronic transactions or data transfers, even if they were rendered unusable for purposes of deception.

[*updated 26.02.2018*]

Module content:
1. General information about the field
   Tools
   Literature

2. Introduction
   Definition of terms
   Motivation for authorities
   Motivation for companies

3. Principles of IT forensics
   Procedure model
   Digital traces
   Volatile data
   Interpreting data
   Interpreting time stamps

4. File system basics
   Hard disks, partitioning, file systems
   Unix file management

5. File system analysis
   Creating a file system image
   Analyzing a file system image
   Deleted files
   File carving

6. Analyzing a compromised system
   Process handling
   Rootkits

[*updated 26.02.2018*]

Recommended or required reading:
Forensic Discovery. (Addison-Wesley Professional Computing) (hard cover)
by Daniel Farmer (author), Wietse Venema (author)
http://www.amazon.de/Forensic-Discovery-Addison-Wesley-Professional-Computing/dp/020163497X

File System Forensic Analysis. (soft cover) by Brian Carrier (author)
http://www.amazon.de/System-Forensic-Analysis-Brian-Carrier/dp/0321268172

[*updated 26.02.2018*]

IT Security Project

Module name (EN): IT Security Project

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-PITS

Hours per semester week / Teaching method:
4PA (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
English/German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

KI633 (P221-0088) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-PITS (P221-0088) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-PITS (P221-0088) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI89 (P221-0088) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-PITS (P221-0088) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-PITS (P221-0088) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this project, students are able to deal with security-related issues by means of a practical project.
They will be able to identify and analyze security problems and, based on this, explain classic methods of attack.
In addition, they will be able to combine attack techniques and describe how systems can be hardened against them.

[*updated 05.03.2020*]

Module content:
A selection of project tasks will be presented.
The tasks are worked on independently by the students in small groups.
Regular meetings are held to report on the progress of the project.
The results are summarized in a document and presented in a talk.

[*updated 14.02.2020*]

Recommended or required reading:
Relevant online references to security issues, journal articles etc.

[*updated 14.02.2020*]

Kinematic Principles of Robotics

Module name (EN): Kinematic Principles of Robotics

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-KGR

Hours per semester week / Teaching method:
3V+1U (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:

[*updated 19.12.2023*]

Applicability / Curricular relevance:

BMT2505.KGR (P221-0197) Biomedical Engineering, Bachelor, ASPO 01.10.2018 , semester 5, optional course
BMT2505.KGR (P221-0197) Biomedical Engineering, Bachelor, SO 01.10.2025 , semester 5, optional course
E2588 (P221-0197) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , semester 5, optional course
KIB-KGR (P221-0197) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course
MAB_19_4.2.1.39 (P221-0197) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019 , semester 5, optional course
MST2.KGR (P221-0197) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 5, optional course
PIB-KGR (P221-0197) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-KGR (P221-0197) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course
PRI-KGR Production Informatics, Bachelor, SO 01.10.2023 , semester 5, optional course
PRI-KGR Production Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Michael Kleer

Lecturer: Prof. Dr. Michael Kleer

[*updated 13.01.2026*]

Learning outcomes:
Students will be able to demonstrate and apply the most important methods for describing and calculating robot systems. They will be able to independently explain and calculate the interaction of robot systems with several coordinate systems and the associated coordinate transformations in detail. In addition, students will be able to independently calculate the forward and inverse kinematics of typical industrial robots and solve path and trajectory planning tasks.

[*updated 19.12.2023*]

Module content:
1. Classifying robot workspaces
2. Principles of rotations, transformations, coordinate system representations
3. Introduction to homogeneous transformations
4. Introduction to the Denavit-Hartenberg transformation method
5. Forward and inverse kinematics of serial robots
6. Basics of the Jacobian matrix
7. The fundamentals of path and trajectory planning

[*updated 19.12.2023*]

Recommended or required reading:
Springer Handbook of Robotics, https://doi.org/10.1007/978-3-540-30301-5
Robot Modeling and Control, ISBN: 978-1-119-52404-5

[*updated 19.12.2023*]

Law for Business Founders

Module name (EN): Law for Business Founders

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-REXG

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI673 (P221-0090) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-REXG Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-REXG Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.7.3 Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course, non-technical
PIBWN56 (P221-0090) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-REXG Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-REXG Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
RA Cordula Hildebrandt

Lecturer: RA Cordula Hildebrandt

[*updated 13.01.2026*]

Learning outcomes:
The course provides students with the important legal knowledge necessary for founding and operating a company.

After successfully completing this module, they will be able to select the right form of company for setting up a business and examine the corresponding possibilities for funding.

Students will be able to answer typical questions about setting up a company:
Which contracts does a young entrepreneur have to conclude to cover his own needs?
What is important when concluding a contract with a customer?
Which liability issues and protection options are relevant?

Students will be able to model the path from the initial idea to operation and use practical examples to assess the legal possibilities and dangers.

[*updated 26.02.2018*]

Module content:
1. Introduction Idea, business plan

2. Paths to starting your own company:
forming a new company, participation, takeover

3. Funding, grants

4. Contract law, drafting a contract

5. Advertising, unfair competition

6. Liability, insurance

[*updated 26.02.2018*]

Recommended or required reading:
Starting a business:
http://www.existenzgruender.de/
http://www.ihk-nordwestfalen.de/existenzgruendung/index.php
http://www.franchiseportal.de/franchise-franchising/Article/ID/19/Session/1-ai7bwP5t-0-IP/Start.htm

Legislative texts:
http://bundesrecht.juris.de/aktuell.html (BGB)
http://www.jurawelt.de/ (contract law)

[*updated 26.02.2018*]

Machine Learning

Module name (EN): Machine Learning

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MLRN

Hours per semester week / Teaching method:
2V+2U (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
English

Assessment:
Written exam, Duration 90 min.

[*updated 13.10.2024*]

Applicability / Curricular relevance:

KI575 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-MLRN (P221-0085) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-MLRN (P221-0085) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI19 (P610-0536) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-MLRN (P221-0085) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, informatics specific
PIB-MLRN (P221-0085) Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, informatics specific
PRI-MLRN Production Informatics, Bachelor, SO 01.10.2023 , semester 6, optional course, informatics specific
PRI-MLRN Production Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Klaus Berberich

Lecturer: Prof. Dr. Klaus Berberich

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will know about fundamental supervised and unsupervised methods from machine learning. This includes methods for regression, classification (e.g., logistic regression and decision trees), and clustering. Students will understand how these methods work and know how to use existing implementations (e.g., in libraries such as scikit-learn). Given a practical problem setting, they will be able to choose a suitable method, apply it to the dataset at hand, and assess the quality of the determined model. In addition, students will be aware of typical data-quality issues and know how to resolve them.

[*updated 13.10.2024*]

Module content:
Machine learning plays an increasingly important role with applications ranging from recognizing handwritten digits, via filtering out unwanted span e-mails, to the ranking of results in modern search engines. After successfully completing this module, students will know about fundamental supervised and unsupervised methods of machine learning. We will look into how these methods are defined formally, including the mathematics behind them. Moreover, we will apply all methods on concrete datasets to solve

practical problems. To do so, we will rely on existing libraries (e.g., scikit-learn) that provide efficient implementations of the methods. This course will be accompanied by theoretical exercises and project assignments. The exercises will help students to deepen their understanding of the methods, while the project assignments will encourage students to solve practical problems by applying their knowledge to real-world datasets.

1. Introduction
- What is Machine Learning?
- Applications
- Libraries
- Literature

2. Working with data
- Typical data formats (e.g., CSV, spreadsheets, databases)
- Data quality issues (e.g., outliers, duplicates)
- Scales of measures (i.e., nominal, ordinal, numerical)
- Data pre-processing (in Python and using UNIX command line tools)

3. Regression
- Ordinary least squares
- Multiple linear regression
- Non-linear regression
- Evaluation

4. Classification
- Logistic regression
- k-nearest neighbors
- Naive Bayes
- Decision trees
- Neural networks
- Evaluation

5. Clustering
- k-means
- Hierarchical agglomerative/divisive clustering
- Density-based clustering
- Evaluation

6. Outlook
- Ongoing research
- Competitions (e.g., Kaggle and KDD Cup)
- Other resources (e.g., KDnuggets)

[*updated 13.10.2024*]

Recommended or required reading:
A. Burkov: The Hundred-Page Machine Learning Book,
self published, 2019
http://themlbook.com

G. James, D. Witten, T. Hastie, R. Tibshirani, Jonathan Taylor: An Introduction to Statistical Learning - with Applications in Python,
Springer 2023

S. Raschka and V. Mirjalili: Python Machine Learning,
Packt Publishing, 2019

M. J. Zaki und W. Meira Jr.: Data Mining and Analysis: Fundamental Concepts and Algorithms,
Cambridge University Press, 2020

[*updated 13.10.2024*]

Mathematical Software Systems and Algorithmic Applications

Module name (EN): Mathematical Software Systems and Algorithmic Applications

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MSAA

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Case studies/Project collection

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI637 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-MSAA Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-MSAA Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI91 (P221-0117) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-MSAA Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-MSAA Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:

60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Barbara Grabowski

Lecturer: Prof. Dr. Barbara Grabowski

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be familiar with typical mathematical software, know its advantages and disadvantages, can classify it according to type and application areas and can develop solution algorithms for simpler problems and implement them in a suitable language. They will be able to differentiate between computer algebra systems, numerical systems, statistical software, graphical systems and logical programming languages. They will be familiar with the problems of rounding errors and error propagation and know how to control such errors.
Furthermore, they will be able to manipulate and analyze mathematical terms with the typical data and control structures of computer algebraic systems (CAS) and implement algorithms for symbolic term transformations.

[*updated 19.02.2018*]

Module content:
1. Problems of rounding errors, error propagation

2. Classification of common math software systems
2.1. Numerical packages
(classification, computation accuracy, rounding problems,
error propagation, typical examples)
2.2. Computer algebraic systems
(classification, exact computations, symbolic computation, runtime problems, typical examples)
2.3. Other software
(graphical CAS, statistics packages, software for TR, typical examples)
2.4. Declarative languages
(description of the problem and not the solution algorithm, typical examples)

3. CAS
3.1. General elementary concepts of computer algebra
3.2. Recursive structure of mathematical expressions
3.3. Elementary mathematical algorithms, case study
3.4. Recursive mathematical algorithms, case study
3.5. Polynomials, exponential and trigonometric transformations, case study

4. Solving problems with mathematics software
4.1 SPSS
4.1.1 Introduction to SPSS
4.1.2 Case studies: Data mining methods Cluster analysis and exploratory data analysis with SPSS

4.2 MAPLE
4.2.1. Introduction, data structures, control structures, MAPLE programming environment
4.2.2 Case studies: Sorting and search methods,
solving equation systems,
route planning, graph theory and coding
4.3 MatLab
4.3.1. Introduction, data structures, control structures, MatLab development environment
4.3.2 Case studies: Numerical methods for interpolation and approximation

5. Introduction to PROLOG
5.1. Structure: clauses, facts and rules
5.2. The backtracking algorithm
5.3. Lists and recursion in PROLOG
5.4. Creating your own CAS in PROLOG

[*updated 19.02.2018*]

Teaching methods/Media:
100% of the lecture will take place in the PC lab "Angewandte Mathematik, Statistik und eLearning". All of the practical exercises for the lecture, as well as solving exercises, homework and case studies will be done with the e-learning system MathCoach, CAS systems, statistics and mathematics software (AMSEL lab: PC lab: "Angewandte Mathematik, Statistik und eLearning").

[*updated 24.02.2018*]

Recommended or required reading:
Joel S. Cohen, Computer Algebra and Symbolic Computation, Bd1: elemtary algorithms, A.K.Peters Ldt., 2002

BRANDSTÄDT A., Graphen und Algorithmen, B.G.Teubner Stuttgart, 1994

[*updated 19.02.2018*]

Measurements and Simulations in Communications Engineering

Module name (EN): Measurements and Simulations in Communications Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MSNT

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:

[*still undocumented*]

Applicability / Curricular relevance:

KI698 (P222-0077) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-MSNT Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-MSNT Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIB-MSNT Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, informatics specific
PIB-MSNT Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Albrecht Kunz

Lecturer: Prof. Dr. Albrecht Kunz

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to carry out measurements in the laboratory using equipment (e. g. oscilloscope, function generators, transmitter, spectrum analyzer, etc.), evaluate, interpret and then present their measurement results.

Students will be familiar with the relevant simulation tools used in communications engineering and digital technology. They will be able to simulate a given circuit and subject the simulation results to a critical comparison with real measured values. They will also be able to explain the measured and simulated phenomena with regard to the circuit technology used.

Students will be capable of working independently on more complex simulation and measurement tasks. In addition, they will acquire basic knowledge in semiconductor technology in order to be able to use the right circuitry techniques for various applications.

[*updated 19.02.2018*]

Module content:
1. Basics
1.1 Basics of telecommunications electronics and semiconductor technology
1.2 Introduction to and practice in working with the simulation tools ORCAD PSPICE and Matlab/Simulink

2. Simulation and measurement of analog modulation methods
2.1 Measurements on test setups in the telecommunication electronics lab
2.1 Simulation of analog modulation methods with ORCAD PSPICE and Matlab/Simulink

3. Simulation of digital modulation methods
3.1 Simulation of a digital transmission chain with Matlab
3.2 Analysis of bit error rates subject to SNR (via simulation in comparison with theory)

4. Aspects of communications engineering in audio transmission
4.1 Basics A/D and D/A conversion
4.2 Simulation of the different A/D and D/A converter concepts using ORCAD PSPICE

5. RFID technology and demonstration
5.1 Programming of the Arduino Uno board / RFID RC522 module

6. Simulation of circuits from digital technology
6.1 Structure of different counters (e. g. Gray code)
6.2 Pseudorandom number generators
6.3 Analysis of the properties of M-sequences (autocorrelation, cross correlation)
6.4 Use of pseudorandom number generators in mobile communication

[*updated 19.02.2018*]

Teaching methods/Media:
Measurements and simulations in the telecommunication electronics lab
Equipment used: Oscilloscope, function generators, measuring transmitters, AM/FM modulators, spectrum analyzers, CMOS/TTL gates, transmission gate, PLL
Simulators used: ORCAD PSPICE, Matlab/Simulink, digital technology simulators
The following should be used for presentations during the final demonstration: MS PowerPoint, white board, flipchart

[*updated 19.02.2018*]

Recommended or required reading:
Werner, M.: Nachrichtentechnik, Vieweg Teubner Verlag
Proakis, Salehi: Contemporary Communication Systems using MATLAB, Brooks/Cole
Rutledge, D.: The Electronics of Radio, Cambridge University Press
Fliege, Gaida: Signale und Systeme: Grundlagen und Anwendungen mit MATLAB, Schlembach Fachbuchverlag
Kammeyer: MATLAB in der Nachrichtentechnik, Schlembach Fachbuchverlag
Heinemann, PSPICE: Einführung in die Elektroniksimulation, Hanser Verlag
Werner, M.: Digitale Signalverarbeitung mit MATLAB: Grundkurs mit 16 ausführlichen Versuchen, Vieweg Teubner Verlag
Baker, R. Jacob: CMOS Circuit Design, Layout, and Simulation, IEEE Press Series on Microelectronic Systems
DeMassa, Thomas A.: Digital Integrated Circuits, John Wiley & Sons
Hilleringmann, U.: Silizium Halbleitertechnologie, Vieweg TeubnerVerlag

Globisch, Lehrbuch Mikrotechnologie, Hanser Verlag

[*updated 19.02.2018*]

Mentoring

Module name (EN): Mentoring

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MENT

Hours per semester week / Teaching method:
2S (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Seminar paper

[*updated 19.02.2018*]

Applicability / Curricular relevance:

BMT2590.MEN (P200-0018) Biomedical Engineering, Bachelor, ASPO 01.10.2018 , semester 5, optional course
BMT2590.MEN (P200-0018) Biomedical Engineering, Bachelor, SO 01.10.2025 , semester 5, optional course
KI591 (P200-0018) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, non-technical
KIB-MENT (P200-0018) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, non-technical
KIB-MENT (P200-0018) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, non-technical
MAB.4.2.1.15 (P200-0018) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 3, optional course
PIBWN39 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-MENT (P200-0018) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, not informatics specific
PIB-MENT (P200-0018) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific
PRI-MENT (P200-0018) Production Informatics, Bachelor, SO 01.10.2023 , semester 5, optional course, not informatics specific

PRI-MENT (P200-0018) Production Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Sandra Wiegand, M.A.

Lecturer: Sandra Wiegand, M.A.

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, the students will have acquired the following competences:
- They will know, understand and be able to explain the structure of mentoring programs
- They will know and understand theories of conversation techniques and be able to apply them during consultations
- They will be able to plan and conduct consultations and group discussions
- They will be able to reflect upon and optimize their consulting competences
- They will be able to build new networks

(Text form: In addition to teaching the history, structure and background of mentoring programs in general, this course is intended help students become familiar with the university´s internal mentoring program. Students will get to know different theories of conversation and practice using them. By means of different methods, students will learn to reflect upon and optimize their own consulting skills. For the duration of one semester, students will support a group of 6-10 other students via group work and individual counselling. Through regular inter-faculty meetings, students will establish new networks.

[*updated 19.02.2018*]

Module content:
- Definition, history and background of mentoring programs in the USA and Europe
- Structure and course of the HTW mentoring program
- Theories in conversation management
- Theories about group dynamics
- Non-verbal communication
- Schulz von Thun communication model
- Constructive criticism
- Giving feedback
- Active listening
- Assuming roles
- Planning, structuring and recording consultations and group discussions

[*updated 19.02.2018*]

Teaching methods/Media:
Worksheets and guidelines for the course and presentations, slide handouts, work in small groups, role playing

[*updated 26.02.2018*]

Recommended or required reading:
Deutsches Jugendinstitut e.V. (Hrsg.) (1999): Mentoring für Frauen. Eine Evaluation verschiedener Mentoring Programme. München.

Haasen, Nele (2001): Mentoring. Persönliche Karriereförderung als Erfolgskonzept. München.

Heinze Christine (2002): Frauen auf Erfolgskurs. So kommen Sie weiter mit Mentoring. Freiburg.

Krell, Gertraude (Hrsg.) (1997): Chancengleichheit durch Personalpolitik,Wiesbaden

[*updated 19.02.2018*]

Methods and Applications from the Field of Artificial Intelligence for Signal and Image Processing

Module name (EN): Methods and Applications from the Field of Artificial Intelligence for Signal and Image Processing

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-KISB

Hours per semester week / Teaching method:
4PA (4 hours per week)

ECTS credits:
5

Semester: according to optional course list

Mandatory course: no

Language of instruction:
German

Assessment:
Short paper and presentation

[*updated 24.02.2018*]

Applicability / Curricular relevance:

KI578 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , optional course, technical
KIB-KISB Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course,

technical
KIB-KISB Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, technical
PIBWI22 (P221-0119) Applied Informatics, Bachelor, ASPO 01.10.2011 , optional course, informatics specific
PIB-KISB Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, informatics specific
PIB-KISB Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Ahmad Osman

Lecturer: Prof. Dr.-Ing. Ahmad Osman

[*updated 13.01.2026*]

Learning outcomes:
Students will learn the practical and scientific methods of project work by writing a paper based on examples, problems and applications from the field of signal and image processing with AI, e. g. research on the state of knowledge and technology in image processing, classification methods, regression procedures, data compression, data reconstruction, human-machine interaction, literature research (also in English), presentation of project results.

After successfully completing this module, students will be able to document and explain their approach. They will be able to defend and explain their results achieved using the engineering knowledge they have acquired. This will enable them to illustrate the use of the above methods within project work.

[*updated 24.02.2018*]

Module content:
Image processing: filtering techniques

Image segmentation: region-based or contour-based methods

Classification methods: neural networks, support vector machine etc.

Data fusion: Evidence Theory

Data reconstruction

Data visualization

Data compression

Human-machine interaction

Research to deepen technical or scientific aspects in the form of a supervised short paper. Literature research (incl. English specialist literature).

Scientific presentations.

[*updated 24.02.2018*]

Teaching methods/Media:
Short paper with academic supervision on a clearly defined research topic using scientific project work methods. Participants will be familiar with the state of research/technology in selected areas of artificial intelligence and will be capable of dealing with research and development projects.

[*updated 24.02.2018*]

Recommended or required reading:
G. Görz (Hrsg.): Handbuch der Künstlichen Intelligenz - München: Oldenbourg Wissenschaftsverlag, 2003
C-M. Bishop: Pattern Recognition and Machine Learning - Springer Verlag, 2007
Russell/Norvig: Artificial Intelligence: a modern approach - (3rd Ed.), Prentice Hall, 2009
Mitchell: Machine Learning - McGraw-Hill, 1997
Luger: Artificial Intelligence: Structures and Strategies for Complex Problem Solving - (6th Ed.), Addison-Wesley, 2008

Independent research is also part of the term paper.

[*updated 24.02.2018*]

Mobile Application Development (Android)

Module name (EN): Mobile Application Development (Android)

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-MADA

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Exercises, project and presentation

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI599 (P221-0086) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-MADA Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-MADA Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI42 (P221-0086) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-MADA Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-MADA Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Christoph Karls, M.Sc.

Lecturer: Christoph Karls, M.Sc.

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to explain the basics of application development in the context of mobile applications and work with a corresponding development environment (e. g. Android Studio).
They will be familiar with the basic concepts of the Android operating system (e. g. activities, intents, services and threads) and can plan and implement applications independently.
Students will put the above mentioned topics to the test in exercises. This will enable them to develop an integrated solution for a given task in a final project independently and in a problem-oriented manner.

[*updated 19.02.2018*]

Module content:
- Basics
- Programming environment & special toolchain
- Activities and life cycle
- User interfaces
- Intents and broadcast receiver (communication between application components)
- Services and threads
- Persistence

- Content provider
- Sensors and actuators
- Miscellaneous

[*updated 19.02.2018*]

Teaching methods/Media:
Android smartphones and tablets, transparencies, projector, board, project and group work, lecture-relevant exercises, oral presentations by students

[*updated 19.02.2018*]

Recommended or required reading:
http://www.android.com
http://developer.android.com
MarkL.Murphy,Commonsware,TheBusyCoder_sGuide to Android Development - https://commonsware.com/Android/

[*updated 19.02.2018*]

Numerical Software

Module name (EN): Numerical Software

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-NUMS

Hours per semester week / Teaching method:
2V+2PA (4 hours per week)

ECTS credits:
5

Semester: according to optional course list

Mandatory course: no

Language of instruction:
German

Assessment:
Case studies and micro-projects with the applications discussed

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI672 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical

KIB-NUMS (P221-0087) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course, technical
KIB-NUMS (P221-0087) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, technical
MST.NSW (P221-0087) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , optional course, technical
MST.NSW (P221-0087) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , optional course, technical
MST.NSW (P221-0087) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course, technical
PIBWI92 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-NUMS (P221-0087) Applied Informatics, Bachelor, ASPO 01.10.2022 , optional course, informatics specific
PIB-NUMS (P221-0087) Applied Informatics, Bachelor, SO 01.10.2026 , optional course, informatics specific
MST.NSW (P221-0087) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , optional course, technical

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Gerald Kroisandt

Lecturer: Prof. Dr. Gerald Kroisandt

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to independently implement algorithms using Matlab to solve mathematical problems, process experimental data and display this data graphically.

[*updated 19.02.2018*]

Module content:
- Programming in Matlab
- Types of Matlab programs
- Graphical output in 2D and 3D
- Diagrams of statistical data and measurement data
- Symbolic calculations

Applications:
- Numerical integration
- Regression, interpolation and approximation
- Zero and fixed-point search
- Gradient method

[*updated 19.02.2018*]

Teaching methods/Media:
100% of the lecture will take place in the PC lab "Angewandte Mathematik, Statistik und eLearning". All of the practical exercises for the lecture, as well as solving exercises, homework and case studies will be done with the e-learning system MathCoach and with mathematical numerical software (AMSEL lab: PC lab: "Angewandte Mathematik, Statistik und eLearning").

[*updated 24.02.2018*]

Recommended or required reading:
F. und F. Grupp: MATLAB 7 für Ingenieure: Grundlagen und Programmierbeispiele
O. Beucher: MATLAB und Simulink: Grundlegende Einführung für Studenten und Ingenieure in der Praxis (z.B. Pearson Studium, 2008)
W. Schweizer: MATLAB kompakt (z.B. Oldenbourg, 2009)
Lecture notes

[*updated 19.02.2018*]

Oral Presentation Skills

Module name (EN): Oral Presentation Skills

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-RP

Hours per semester week / Teaching method:
2S (2 hours per week)

ECTS credits:
2

Semester: according to optional course list

Mandatory course: no

Language of instruction:
German

Assessment:
Presentation

[*updated 23.09.2025*]

Applicability / Curricular relevance:

BMT2591.RPR (P222-0038) Biomedical Engineering, Bachelor, ASPO 01.10.2018 , optional course

BMT2591.RPR (P222-0038) Biomedical Engineering, Bachelor, SO 01.10.2025 , optional course
EE-K2-554 (P222-0038) Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015 , optional course
E2587 (P222-0038) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course
KIB-RP (P222-0038) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course, not informatics specific
KIB-RP (P222-0038) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, not informatics specific
MAB_19_4.2.1.36 (P222-0038) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019 , optional course
MST.RPR (P222-0038) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course, non-technical
PIB-RP (P222-0038) Applied Informatics, Bachelor, ASPO 01.10.2022 , optional course, not informatics specific
PIB-RP (P222-0038) Applied Informatics, Bachelor, SO 01.10.2026 , optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Studienleitung

Lecturer: Studienleitung

[*updated 13.01.2026*]

Learning outcomes:
Communication skills are now considered fundamental to technology-oriented professional practice and personal development.

In this course, students will be introduced to the basics of rhetoric and presentation for technical professions. Individual coaching will promote students verbal and nonverbal communication skills and strengthen their personal development. This module is highly practice and training-oriented. It offers a mixture of lectures, individual and team work tasks and targeted individual training.

After successfully completing this course, students will have deepened, consolidated and expanded the following competences:
* Finding/strengthening their own style of communication
* Structuring and coordinating technical and target group-specific information
* Developing/consolidating their own rhetorical and presentation skills
* Assessing communication partners and situations
* Giving and receiving feedback
* Using presentation techniques effectively

[*updated 23.09.2025*]

Module content:
1. Principles of rhetoric and presentation
2. Planning a presentation (organization/check list)
3. Content concept (order/structuring information)
4. Rhetorical practice (stylistic devices/argumentation strategies)
5. Visualization concept (working with media, designing slides)
6. Procedure (structure, phase structure)
7. Video- assisted individual training (promotion of verbal and non-verbal communication)
8. Dealing with disruptions (dealing with disruptions and conflicts)

[*updated 23.09.2025*]

Recommended or required reading:
No specific reading knowledge is required for this module. Regular attendance and willingness to train are however important.

Background information is provided in a number of selected publications:

Fey H. u. G.: Sicher und überzeugend präsentieren. Walhalla 1998
Lackner T.: Die Schule des Sprechens. Rhetorik und Kommunikationstraining. Öbv & Hpt, 2000.

[*updated 23.09.2025*]

Preparing for the IELTS Test

Module name (EN): Preparing for the IELTS Test

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-IEL

Hours per semester week / Teaching method:
2VU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam (75%), oral examination (25%)

[*updated 05.10.2020*]

Applicability / Curricular relevance:

BMT2640.IELTS (P213-0041) Biomedical Engineering, Bachelor, ASPO 01.10.2018 , semester 6, optional course
BMT2640.IELTS (P213-0041) Biomedical Engineering, Bachelor, SO 01.10.2025 , semester 6, optional course
KIB-IEL Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-IEL Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB_19_2.1.2.24 (P213-0041) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019 , optional course, general subject
MST.IEL (P200-0023, P213-0041, P231-0133) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course
MST.IEL (P200-0023, P213-0041, P231-0133) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course
MST.IEL (P200-0023, P213-0041, P231-0133) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course
PIB-IEL Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, not informatics specific
PIB-IEL Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
Note:
The module is geared towards Bachelor and Master students in engineering who require the language test IELTS (International English Testing System), Volume 6.5, for admission to a Master´s program or as part of an application for a stay abroad and wish to prepare for it.

The module ends with an examination based on the format of the IELTS test. The examination consists of a written part (75%) on listening comprehension, reading comprehension and writing and an oral exam (25%). Each part must be passed with at least 40%.

The actual IELTS test must be taken at a certified IELTS test center

About this module:
Students will become familiar with the format, structure (reading, listening, writing and speaking) and the various types of exercises that are part of the IELTS test. In addition, they will learn to effectively apply

their foreign language skills, as well as the test strategies they have earned to solving the tasks set in the examination.

[*updated 05.10.2020*]

Module content:
_ Structure and parts of the Academic IELTS test
_ Listening comprehension und listening comprehension strategies
_ Exercises on reading comprehension and reading comprehension strategies (scanning, skimming, reading for gist)
_ Writing exercises (writing short argumentative essays)
_ Writing exercises for describing graphics and trends
_ Structuring texts (coherence and cohesion)
_ Oral exercises to help students learn to present arguments logically
_ General vocabulary and grammar exercises

[*updated 05.10.2020*]

Teaching methods/Media:
The learning goals will be achieved through integrated training of the four basic skills (listening comprehension, reading comprehension, speaking and writing) supported by the use of multimedia. Communicative competence training will take place within the framework of learner-centred lessons in the multimedia computer language laboratory.

[*updated 05.10.2020*]

Recommended or required reading:
The course is based on the following textbook:
Cullen, Pauline, French, Amanda, Jakeman, Vanessa. The Official Cambridge Guide to IELTS. For Academic and General Training (with DVD and answer key). Cambridge University Press, 2014.

Other recommended learning materials: IELTS. Official IELTS Practice Materials 2. (incl. DVD). UCLES, 2010. Jakeman, Vanessa and Mc Dowell, Clare. Action Plan for IELTS (with Audio CD). Academic Module. Cambridge University Press, 2013.

[*updated 05.10.2020*]

Presenting a Project

Module name (EN): Presenting a Project

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SSP

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Oral presentation with grade

[*updated 24.02.2018*]

Applicability / Curricular relevance:

KI574 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-SSP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-SSP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
PIBWN33 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-SSP Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-SSP Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Suitable for exchange students (learning agreement)

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
This compulsory elective course is based on the mandatory Bachelor module "Professional Presentations". The focus of this module will be the oral presentation of a project carried out at university, student conference or the workplace.

To this end, students will deepen their strategic knowledge in order to be able to give professional, subject-specific presentations, define quality criteria and further develop their language skills. They will test and hone these strategies, their knowledge and their skills in short presentations at different presentation phases and receive feedback from their fellow students. Students will learn how to combine the phases of

their presentation to form a whole, how to enhance their presentations with the help of visual aids, how to prepare themselves for their presentation in a targeted manner and finally, how to give their presentation.

[*updated 24.02.2018*]

Module content:
- Repetition and application of the strategies taught in the _Professional Presentations_ module
- Visual aids
- Establishing contact with the audience
- Voice and body language
- Short presentations
- Peer review

In addition, we will work on:
Repeating relevant linguistic resp. grammatical structures (where necessary)
Intercultural competence
Raising awareness for functional language use

[*updated 24.02.2018*]

Teaching methods/Media:
Teaching and learning materials for specific target groups (print, audio, video)

[*updated 24.02.2018*]

Recommended or required reading:
Students will receive a list of recommended teaching and learning materials.
The following materials are free of charge for students of the htw saar. We recommend their use for independent learning:

- Christine Sick, unter Mitarbeit von Miriam Lange (2011): TechnoPlus Englisch 2.0 (Multimediales Sprachlernprogramm für Technisches und Business Englisch, Niveau B1-B2+), EUROKEY.

- Christine Sick (2015): TechnoPlus Englisch VocabApp (Mobile-Learning-Angebot insbesondere zum Grundwortschatz, alle Niveaustufen), EUROKEY.

[*updated 24.02.2018*]

Principles of Web Development

Module name (EN): Principles of Web Development

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-WEB

Hours per semester week / Teaching method:
2V+2U (4 hours per week)

ECTS credits:

5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KIB-WEB (P221-0023) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course
KIB-WEB (P221-0023) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-WEB (P221-0023) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, mandatory course
PIB-WEB (P221-0023) Applied Informatics, Bachelor, SO 01.10.2026 , semester 3, mandatory course

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Maximilian Altmeyer

Lecturer: Prof. Dr. Maximilian Altmeyer

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be familiar with the structure of XML documents. They will be able to analyze the structure of existing documents and design a suitable schema. Students will be capable of converting XML documents with XSLT to HTML and creating a layout with CSS. They will be able to use JavaScript to access the content of XML documents (especially XHTML), process it, and output it in another format.

[*updated 19.02.2018*]

Module content:
XML basics
Unicode
XHTML
CSS
XSL Transformations (XSLT)
XPath
XML schemas
Document Object Model (DOM)
Principles of JavaScript
JavaScript and the Document Object Model
Events in JavaScript
JavaScript and CSS

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture, demonstration, exercises

[*updated 19.02.2018*]

Recommended or required reading:
Flanagan, David: JavaScript - Das umfassende Referenzwerk, O´Reilly, 2012.
Mozilla Developer Network, https://developer.mozilla.org/de/
Harold, E.R., MMeans W.S., XML in a Nutshell, O_Reilly, 2005
Kay, Michael: XSLT 2.0 and XPath 2.0 Programmer´s Reference 4th edition, Wrox Press, 2008.
W3C: Extensible Markup Language (XML) 1.0 (Fifth Edition), https://www.w3.org/TR/xml/

[*updated 19.02.2018*]

Programming Tools

Module name (EN): Programming Tools

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-PRGW

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project

[*updated 24.02.2018*]

Applicability / Curricular relevance:

DFBI-443 (P610-0254) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018 , optional course, informatics specific
DFIW-PWZ (P610-0193) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 4, mandatory course, informatics specific
KI569 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, informatics specific
KIB-PRGW (P221-0124) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-PRGW (P221-0124) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI13 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-PRGW (P221-0124) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-PRGW (P221-0124) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Reinhard Brocks

Lecturer: Prof. Dr. Reinhard Brocks

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to choose the suitable tools for each phase of the implementation process. They will be able to define the toolchain for a software project, configure its development environment, and implement an automatic build process. They will be able to explain the basic functions of different programming tools and use them for a specific programming language Students will be capable of describing the structure of program libraries and frameworks and will be able to create them themselves or integrate them into their own projects. They will be able to use integrated development environments for software development.

[*updated 24.02.2018*]

Module content:
- Functions within source code editors

- Command line and scripts
- Software documentation tools
- Build tools
- Integrated development environments and their configuration
- Debuggers
- Version management
- Test frameworks
- Static source code analysis tools
- Profilers
- Issue tracking systems
- Cross-compiling
- Bug tracking systems
- Package managers
- Virtual machines

[*updated 24.02.2018*]

Teaching methods/Media:
Examples, project work, practical course with exercises, group work

[*updated 24.02.2018*]

Recommended or required reading:
Original documentation for the various software development tools

Brocks, R.: Open Educational Resources / OER zu Programmierwerkezuge, https://www.htwsaar.de/ingwi/fakultaet/personen/profile/Reinhard%20Brocks/open-educational-resources , 2019
Zeller, A., Krinke, J.: Open-Source-Programmierwerkzeuge, dpunkt, 2003
Preißel, René; Stachmann, Bjørn: Git : dezentrale Versionsverwaltung im Team; Grundlagen und Workflows, dpunkt, 2012
Jürgen Wolf; Stefan Kania : Shell-Programmierung : das umfassende Handbuch; Einführung, Praxis, Übungsaufgaben, Kommandoreferenz; Bonn : Galileo Press, 2013
Helmut Herold : UNIX und seine Werkzeuge, Make und nmake : Software-Management unter UNIX und MS-DOS, Addison-Wesley, 1994
Bernd Matzke: Ant : eine praktische Einführung in das Java Build-Tool, Heidelberg : dpunkt-Verl., 2005
Martin Spille: Maven 3 : Konfigurationsmanagement mit Java, mitp, 2011
Michael Tamm : JUnit-Profiwissen : effizientes Arbeiten mit der Standardbibliothek für automatisierte Tests in Java; Heidelberg : dpunkt-Verl., 2013
Durelli, Vinicius H. S. ; Araujo, Rodrigo Fraxino ; Rafael Medeiros Teixeira: Getting Started with Eclipse Juno; Birmingham : Packt Publishing, 2013

[*updated 30.07.2021*]

Risk-Based Decision Making and Statistical Data Analysis

Module name (EN): Risk-Based Decision Making and Statistical Data Analysis

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ERSD

Hours per semester week / Teaching method:
2V+2P (4 hours per week)

ECTS credits:
4

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI626 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-ERSD (P221-0107) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-ERSD (P221-0107) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
PIBWI94 (P221-0106) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-ERSD (P221-0107) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-ERSD (P221-0107) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Melanie Kaspar, M.Sc.

Lecturer: Melanie Kaspar, M.Sc.

[*updated 13.01.2026*]

Learning outcomes:
After completing this course, students will be able to analyze and evaluate large amounts of data and statistically evaluate it using software.
In addition, they will be able to make statements on the reliability and statistical certainty of their evaluation results.

[*updated 26.02.2018*]

Module content:
1. Risk-Based Decision Making:
   1.1 Bayesian networks
   1.2 Decision trees
   1.3 Boolean reliability theory
   1.4 Markov chains
   1.5 Statistical decisions: hypothesis testing and estimates
   1.6 Decisions in contingency tables
   1.7 Software: SPSS, Answertree
   1.8 Case studies
2. Statistical data analysis - data mining with statistical methods
   2.1 Scale types of random features
   2.2 Statistical measures for data sets
   2.3 Correlations
   2.4 Cluster analysis technique – data aggregation
   2.5 Probit analyses
   2.6 Software: SPSS, Clementine
   2.7 Case studies

[*updated 26.02.2018*]

Teaching methods/Media:
100% of the lecture will take place in the PC lab AMSEL "Angewandte Mathematik, Statistik und eLearning". Computer-supported practical case studies will be carried out here using SPSS and R.

In addition, the eLearning system MathCoach-Statistik (AMSEL PC laboratory 5306) will be used. Students must complete homework and exercises using this system.

[*updated 24.02.2018*]

Recommended or required reading:
Lecture notes: B.Grabowski: Entscheidungen unter Risiko und statistische Datenanalyse, HTW, 2010

J.Janssen, W. Laaz: Statistische Datenanalyse mit SPSS, Springer, 2009

Handbooks: Answertree, Clementine, SPSS

[*updated 19.02.2018*]

Robotics Lab Course

Module name (EN): Robotics Lab Course

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ROBP

Hours per semester week / Teaching method:
2P (2 hours per week)

ECTS credits:
4

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI627 (P222-0078) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-ROBP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-ROBP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI95 (P221-0174) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-ROBP Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-ROBP Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 97.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Ing. Dirk Ammon

Lecturer: Dipl.-Ing. Dirk Ammon

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be familiar with the properties and effects of different sensors and actuators and how these can be modeled in software. Students will learn methods of navigation and mapping for mobile robots and how to use them. Students will be able to construct and program a mobile robot that fulfills a specific task.

[*updated 19.02.2018*]

Module content:

1. Theory
- History of robotics, overview of robotics,
- Sensors and actuators
- Evaluation of measured values and sensor fusion
- Odometry and dead reckoning
- Mapping methods

II. Practice
Creating a mobile robot Groups consisting of 2 students each receive the necessary equipment.
. Familiarization with the hardware and software by means of simple exercises and tasks
- Group-specific project
- Building and programming the robot, realization and test
- Documentation
- Lecture with presentation

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture with PowerPoint slides in the theoretical part, supervised practical experiments during the practical phase, work in largely independent individual groups with accompanying project discussions during the realization.

[*updated 19.02.2018*]

Recommended or required reading:
NEHMZOW, Ulrich, Mobile Robotik, "Eine praktische Einführung", Springer Verlag Berlin-Heidelberg, 2002
GOCKEL, DILLMANN, Embedded Robotics, "Das Praxisbuch", Elektor-Verlag, Aachen, 2005

[*updated 19.02.2018*]

Ruby on Rails

Module name (EN): Ruby on Rails

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-RUBY

Hours per semester week / Teaching method:
3V+1P (4 hours per week)

ECTS credits:
4

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI680 (P221-0091) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-RUBY Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-RUBY Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI72 (P221-0091) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-RUBY Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-RUBY Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Inf. Julian Fischer

Lecturer: Dipl.-Inf. Julian Fischer

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will understand the basic concepts of modern web development.

They will be able to apply Ruby and Ruby on Rails paradigms and can combine Ruby´s ecosystem building blocks to map application events.

Students will be able to identify the layers of a web application, as well as identify and correct the origin of errors. This gives them the ability to correct and develop Ruby applications.

In addition, they will also be able to estimate the challenges a cloud environment can pose for a web application and how to solve them. This will allow them to develop scalable Ruby on Rails applications.

[*updated 26.02.2018*]

Module content:
Principles of the object-oriented language Ruby
- Introduction to the metaprogramming in Ruby

Test-driven development with Ruby and RSpec
Source code versioning with Git
Architecture of the Ruby on Rails framework
- The Model View Controller Paradigm on the Web
- Exception handling, introduction to the object relationship mapper Active Record
- Action controller
- Action view

Web services with Ruby and Ruby on Rails
- REST
- OAuth2

Cloud concepts with Ruby on Rails applications
- File storage and access in the cloud

[*updated 19.02.2018*]

Teaching methods/Media:
Lecture, discussion, demonstration

[*updated 19.02.2018*]

Recommended or required reading:
D. A. BLACK, The Well Grounded Rubyist, Manning, 2009
JOSÈ VALIM, Crafting Rails Applications, The Pragmatic Programmers, 2011
RAYAN BIGG, YEHUDA KATZ, Rails3 in Action, Manning, 2011
S. RUBY, Web Development with Ruby on Rails, The Pragmatic Programmers, 2011

[*updated 19.02.2018*]

Running RoboNight Workshops

Module name (EN): Running RoboNight Workshops

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-ROBO

Hours per semester week / Teaching method:
1PA+1S (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
English/German

Assessment:
Participation in 5 classes, 3 workshops, the competition + a written composition

[*updated 24.02.2018*]

Applicability / Curricular relevance:

KI628 (P200-0007) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-ROBO (P221-0182) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-ROBO (P221-0182) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MST.RNW (P221-0182) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , optional course, non-technical
MST.RNW (P221-0182) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , optional course, non-technical
MST.RNW (P221-0182) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course, non-technical
PIBWN58 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-ROBO (P221-0182) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-ROBO (P221-0182) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific
MST.RNW (P221-0182) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , optional course, non-technical

Suitable for exchange students (learning agreement)

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Steffen Knapp

Lecturer: Prof. Dr. Steffen Knapp

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, the students will be able to assess the special challenges involved in conducting technical workshops and take them into regard during the preparatory phase of the workshop. They will be able to adapt the contents of the training courses to the participants´ previous knowledge and provide appropriate support in dealing with technical questions. Students will also be able to collect and prepare the knowledge necessary for the course and impart it to the workshop participants in such a manner as to fit their age groups.

[*updated 26.02.2018*]

Module content:
- Create and design the tasks for workshops and the competition
- Design and implement possible solutions
- Supervise 3 workshops
- Supervise the competition
- Conduct follow-up work and document the experiences made

[*updated 26.02.2018*]

Teaching methods/Media:
Introductory workshop for robot programming with Mindstorm robots on computers and tablets, supervised practical course, largely independent development of the contents in groups, project discussions and workshop coaching.

[*updated 26.02.2018*]

Recommended or required reading:
- EV3-Programmierung Kurse, htw saar, EmRoLab 2017
- Programming LEGO NXT Robots using NXC, Daniele Benedettelli
- Workbook Bluetooth, htw saar, EmRoLab 2011
- NXT-Programmierung I und II: Einführung und Fortgeschrittene, htw saar, EmRoLab 2011

[*updated 26.02.2018*]

Russian for Beginners 1

Module name (EN): Russian for Beginners 1

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-RFA1

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

EE-K2-524 (P200-0020) Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012 , semester 5, optional course, non-technical
EE-K2-524 (P200-0020) Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015 , semester 5, optional course, non-technical, course inactive since 14.03.2018
E2426 (P200-0020) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, non-technical
KI607 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-RFA1 (P200-0020) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-RFA1 (P200-0020) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.21 (P200-0020) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course
MAM.2.1.1.20 (P610-0556) Engineering and Management, Master, ASPO 01.10.2013 , optional course, general subject, course inactive since 06.10.2020
PIBWN38 (P200-0020) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-RFA1 (P200-0020) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-RFA1 (P200-0020) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The course _Russian for Beginners 1_ is aimed at learners who have no previous knowledge of the language. The modules _Russian for Beginners 1_ and _Russian for Beginners 2_ are based on one another. In the course of the two modules, participants will first reach proficiency level A1 and then advance to level A2 of the European Framework of Reference for Languages.
The goal of the course is to provide students with basic knowledge of the Russian language, which will enable them to communicate in general and professional situations, both orally and in writing. To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally. We will focus on oral communication in order to develop communicative competence in work-related situations, especially through role playing and the use of dialogues. Important grammatical structures will be taught in order to support and supplement the content of the course.
During the course, intercultural aspects will also be addressed so that students develop an awareness of

cultural specificities and are able to act and communicate appropriately and competently in the respective situations.

[*updated 19.02.2018*]

Module content:
In the course _Russian for Beginners 1_ lessons 1 to 7 from the textbook _Otlitschno 1_ will be worked on.
Establishing contact:
_ Greetings and saying farewell
_ Introducing yourself and others
_ Giving information about yourself requesting information about others
_ Asking how someone is feeling
_ Getting to know business partners
The professional world
_ Describing jobs and activities
_ Arranging appointments
_ Planning activities
Oral and written communication
_ Requesting general information (name, nationality, telephone number, e-mail address)
_ Appointments with colleagues and business partners
_ Time, daily schedule, scheduling
_ Making telephone calls
Intercultural competence
Basic knowledge about Russian culture, history and society
In addition, both the Cyrillic alphabet and basic grammatical structures will be taught (e. g. declination of nouns, noun case usage, adjectives, personal pronouns and prepositions, verb conjugation, syntax)
Students are expected to work on and expand their basic vocabulary independently.

[*updated 26.02.2018*]

Teaching methods/Media:
Teaching and learning materials (print media, slides, audio-visual teaching materials) and recommended podcasts compiled specifically for the learning group.

[*updated 19.02.2018*]

Recommended or required reading:
The course is based on the following textbook and will be supplemented by the following:
Otlitschno 1 Lehrbuch ISBN: 978-3-19-0044771 und Arbeitsbuch ISBN: 978-3-19-014477-8

[*updated 19.02.2018*]

Russian for Beginners 2

Module name (EN): Russian for Beginners 2

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-RFA2

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 19.02.2018*]

Applicability / Curricular relevance:

EE-K2-525 (P200-0021) Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012 , semester 6, optional course
EE-K2-525 (P200-0021) Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015 , semester 6, optional course, course inactive since 14.03.2018
E2427 (P200-0021) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, general subject
KI585 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-RFA2 (P200-0021) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-RFA2 (P200-0021) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.22 (P200-0021) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course
MAM.2.1.1.21 Engineering and Management, Master, ASPO 01.10.2013 , optional course, general subject, course inactive since 06.10.2020
MST.RA2 Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course, non-technical, course inactive since 14.03.2018
MST.RA2 Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course, non-technical, course inactive since 14.03.2018
MST.RA2 Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course, non-technical, course inactive since 14.03.2018
PIBWN34 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-RFA2 (P200-0021) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-RFA2 (P200-0021) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The modules _Russian for Beginners 1_ and _Russian for Beginners 2_ are based on one another. In the course of the two modules, participants will first reach proficiency level A1 and then advance to level A2 of the European Framework of Reference for Languages. The course _Russian for Beginners 2_ is aimed at learners with basic knowledge of the Russian language at level A1 of the European Reference Framework or the module _Russian for Beginners 1_.
The goal of the course is to provide students with basic knowledge of the Russian language, which will enable them to communicate in general and professional situations, both orally and in writing. To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally. We will focus on oral communication in order to develop communicative competence in work-related situations, especially through role playing and the use of dialogues. Important grammatical structures will be taught in order to support and supplement the content of the course.
During the course, intercultural aspects will also be addressed so that students develop an awareness of cultural specificities and are able to act and communicate appropriately and competently in the respective situations.

[*updated 19.02.2018*]

Module content:
In the course _Russian for Beginners 2_ selected lessons from the textbook _Otlitschno 2_ will be worked on.
Work
_ Organizing daily and weekly schedules
_ Times, opening hours
_ Making business calls
_ Writing memos
The professional world
_ Writing and responding to invitations
_ Making hotel reservations per telephone/e-mail
_ Developing an event program for business partners
_ Describing how a company is structured
_ Naming tasks and responsibilities
Professional training and experience
_ Creating a resume
_ Reading and understanding job advertisements
Intercultural competence
Basic knowledge about Russian culture, history and society
In addition, basic grammatical structures (e. g. numbers, time and date, use and declination of nouns, adjectives and personal pronouns, prepositions, verb conjugation, sentence structure) will be taught.
Students are expected to work on and expand their basic vocabulary independently.

[*updated 19.02.2018*]

Teaching methods/Media:
Teaching and learning materials (print media, slides, audio-visual teaching materials) compiled specifically for the learning group and recommended podcasts at www.russlandjounal.de

[*updated 19.02.2018*]

Recommended or required reading:
The course is based on the following textbook and will be supplemented by the following:
Otlitschno 2 Lehrbuch ISBN: 978-3-19-0044778-8 und Arbeitsbuch ISBN: 978-3-19-014478-5

[*updated 19.02.2018*]

Semiconductor Technology and Production

Module name (EN): Semiconductor Technology and Production

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-HLTP

Hours per semester week / Teaching method:
4V (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written exam

[*updated 26.02.2018*]

Applicability / Curricular relevance:

KI608 (P222-0076) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-HLTP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-HLTP Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI32 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-HLTP Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-HLTP Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Albrecht Kunz

Lecturer: Prof. Dr. Albrecht Kunz

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will have comprehensive knowledge about current microelectronic production methods. This knowledge will enable them to classify and assess the limits and possibilities of integrated semiconductor devices and their circuit families.

Students will have detailed knowledge about common circuit families. They will understand the differences between the different circuit families and be able to analyze and evaluate them by using numerically generated simulation results with regard to possible applications.

[*updated 26.02.2018*]

Module content:
1.Technological processes:
1.1.Trends in microelectronics,
1.2.Materials,
1.3.Wafer fabrication,
1.4.Oxidation, lithography, etching and doping techniques,
1.5.Deposition methods,
1.6.MOS and bipolar technologies for circuit integration,
1.7.Integration examples

2.Semiconductor circuit families:
2.1.Diode transistor logic,
2.2.Transistor-transistor logic,
2.3.Emitter-coupled logic,
2.4.Integrated injection logic,
2.5.NMOS circuits

[*updated 26.02.2018*]

Recommended or required reading:
Baker, R. Jacob: CMOS Circuit Design, Layout, and Simulation, IEEE Press Series on Microelectronic Systems,
Uyemura, John P.: CMOS Logic Circuit Design, Kluwer Academic Publishers,
DeMassa, Thomas A.: Digital Integrated Circuits, John Wiley & Sons,
Hilleringmann, U.: Silizium Halbleitertechnologie, Teubner-Verlag,
Wupper, H.: Elektronische Schaltungen, Band 1 und 2, Springer-Verlag,

Rein, H. _ M.: Integrierte Bipolarschaltungen, Springer-Verlag,
Post, H. _ U.: Entwurf und Technologie hochintegrierter Schaltungen, Teubner-Verlag,
Paul, Reinhold: Einführung in die Mikroelektronik, Hüthig-Verlag,
Hoppe, Bernhard: Mikroelektronik, Band 1 und 2, Vogel-Verlag.

[*updated 26.02.2018*]

Sino-German Student Club for Smart Sensors

Module name (EN): Sino-German Student Club for Smart Sensors

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SGSC

Hours per semester week / Teaching method:
1V+3PA (4 hours per week)

ECTS credits:
5

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 19.02.2018*]

Applicability / Curricular relevance:

KI696 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-SGSC (P221-0131) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-SGSC (P221-0131) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
PIBWN70 (P221-0131) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-SGSC (P221-0131) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-SGSC (P221-0131) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Martina Lehser

Lecturer: Prof. Dr. Martina Lehser

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to develop a communicative system with sensors and microcontrollers in an international and globally distributed project team. They will learn to assume professional and organizational responsibility und understand and experience the importance of intercultural competence with a focus on China.
In addition, through their work in a project team with different linguistic, social and geographical environments, students will:
- understand the importance of communication in and with the other language environment
- work with team members from different learning backgrounds and nations
- recognize and use different competences
- establish contacts with foreign partners promoting internationalization
- learn to accept and adapt to other work methods

[*updated 19.02.2018*]

Module content:
Students from various fields and levels of study and with different degrees from the htw saar and CDHAW (Tongji Univ., Shanghai) will form a globally distributed team. The team will consist of 5 to 15 students. Over the period of a full semester, the team will work on a specific task within the project.
At the team´s locations, different aspects will be dealt with. At the htw saar the topics will be mechatronics and software and at the CDHAW the topics will be hardware and production.

The project results will be presented to the lecturers in the form of a presentation and a final report.

Project management:
- Specifications
- Project planning
- Version management

Software development:
- Embedded devices
- TCP/IP communication
- Data logging

Electrical Engineering/Mechatronics:
- Electronic circuits
- Test design environment
- CAD design - casing parts

Intercultural competence:
- Focus: China
- Patterns of communication
- Work methods
- The concept of time

[*updated 24.02.2018*]

Teaching methods/Media:
Lecture, workshop, training
Meeting (face to face & Skype)

[*updated 19.02.2018*]

Recommended or required reading:
- China-Strategie des BMBF 2015_2020: Strategischer Rahmen für die Zusammenarbeit mit China in Forschung, Wissenschaft und Bildung
- Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0: Abschlussbericht des Arbeitskreises Industrie 4.0
- Konflikte und Synergien in multikulturellen Teams, Petra Köppel
- Management von IT-Projekten, Dr. Hans W. Wieczorrek, Dipl.-Math. Peter Mertens
- Führung im Projekt, Dr. Thomas Bohinc
- Embedded Technologies, Joachim Wietzke
- Embedded Linux, Joachim Schröder · Tilo Gockel · Rüdiger Dillmann

[*updated 19.02.2018*]

Software Development for Collaborative Industrial Robots

Module name (EN): Software Development for Collaborative Industrial Robots

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-IROB

Hours per semester week / Teaching method:
4PA (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
English/German

Assessment:
Project with presentation

[*updated 06.11.2020*]

Applicability / Curricular relevance:

KI566 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional

course, technical
KIB-IROB (P221-0132) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-IROB (P221-0132) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
MST.SKI (P221-0132) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 5, optional course, technical
MST.SKI (P221-0132) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 5, optional course, technical
MST.SKI (P221-0132) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 5, optional course, technical
PIBWI08 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-IROB (P221-0132) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-IROB (P221-0132) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Steffen Knapp

Lecturer: Prof. Dr. Steffen Knapp

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this course, students will be able to use their programming skills to make system-specific scripting languages usable. Based on the example of the collaborative and non-collaborative industrial robots used, students will learn how to factor the physical hardware limitations into the implementation. In addition, they will be aware of the need to comply with safety-relevant legal requirements when using industrial robots.

Students will be able to independently develop solutions for common robot applications in industrial manufacturing.

In addition to the professional qualifications in the (interdisciplinary) project team, they will also gather experience in assuming professional and organizational responsibility.

[*updated 17.04.2025*]

Module content:
During this course, students will cover how to program multi-axis collaborative industrial robots.

The aim is to develop and integrate control software to solve common problems in industry.

First Part (lectures, practical exercises):
- Safety aspects when using industrial robots
- Dealing with robot hardware
- System dependent script language (with UR as an example)

Second Part (project):
Development and integration of control software to solve common problems in industry (e.g., assembly processes, pick & place)

[*updated 17.04.2025*]

Teaching methods/Media:
Lecture, seminar, project

[*updated 06.11.2020*]

Recommended or required reading:
http://www.i-botics.de/wp-content/uploads/2016/08/UR3_User_Manual_de_Global.pdf
https://www.universal-robots.com/download/?option=15833

[*updated 06.11.2020*]

Software Development with Jakarta EE

Module name (EN): Software Development with Jakarta EE

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SEJ

Hours per semester week / Teaching method:
2V+2PA (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Project + oral examination

[*updated 23.09.2025*]

Applicability / Curricular relevance:

KIB-SEJ (P221-0215) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-SEJ (P221-0215) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course
PIB-SEJ (P221-0215) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Markus Esch

Lecturer: Prof. Dr. Markus Esch

[*updated 13.01.2026*]

Learning outcomes:

[*updated 23.09.2025*]

Module content:

[*updated 23.09.2025*]

Recommended or required reading:

[*updated 23.09.2025*]

Spanish for Beginners I

Module name (EN): Spanish for Beginners I

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SFA1

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 5

Mandatory course: no

Language of instruction:
Spanish

Assessment:
Written examination (final exam)

[*updated 19.02.2018*]

Applicability / Curricular relevance:

E2424 (P200-0022) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, non-technical
KI663 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, non-technical
KIB-SFA1 (P200-0022) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, non-technical
KIB-SFA1 (P200-0022) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, non-technical
MAB.4.2.1.4 (P200-0022, P620-0568) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course
MST.SA1 (P200-0022) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 5, optional course, non-technical
MST.SA1 (P200-0022) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 5, optional course, non-technical
MST.SA1 (P200-0022) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 5, optional course, non-technical
PIBWN50 (P200-0022) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-SFA1 (P200-0022) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, not informatics specific
PIB-SFA1 (P200-0022) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, not informatics specific
MST.SA1 (P200-0022) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 5, optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The course “Spanish for Beginners I” is aimed towards learners with little or no previous knowledge of the Spanish language. The courses “Spanish for Beginners I and II” are based on each other. In the course of the two modules, students will first reach proficiency level A1 and then advance to level A2 of the European Framework of Reference for Languages.

The goal of the course is to provide students with basic knowledge of the Spanish language, which will enable them to communicate in general and professional situations as quickly as possible, both orally and in writing. To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally. Content development will be supported by the repetition of the relevant grammatical structures.

The course takes a communicative and pragmatic approach that particularly promotes communicative competence in job-relevant situations through the use of role playing and situational dialogues. This also includes intercultural aspects that raise the students´ awareness of cultural differences and enable them to assert themselves in specific situations.

[*updated 30.07.2021*]

Module content:
Content:
In the course Spanish for Beginners I students will learn the lessons 1 to 5 from Meta Profesional A1-A2 (Spanisch für den Beruf. Klett Verlag).

Establishing contact
- Formal greetings
- Introductions
- Asking how someone is feeling
- Giving information about yourself and requesting information about others
- Saying thank you, apologizing and saying goodbye
- Describing a person
- Giving directions
- Getting to know business partners

- Job profiles and the workplace
- Describing jobs and activities
- Types of companies
- Showing and describing products
- Describing departments and responsibilities
- Planning activities
- Interaction with colleagues
- Participating in international trade fairs

Oral and written communication
- Common verbal expressions (asking for names, telephone numbers and e-mail addresses)
- Business lunches
- Making appointments with colleagues
- Requesting and giving information
- Writing e-mails
- Time
- Daily schedule, making appointments

In addition, basic grammar structures will be learned (e. g. indicative presence of regular and irregular verbs, form of progression, prepositions, personal and possessive pronouns, asking questions, syntax).

Students should work on and expand their basic vocabulary independently.

[*updated 30.07.2021*]

Teaching methods/Media:
Teaching and learning materials (print media, slides, audio-visual teaching materials), multimedia learning software compiled specifically for the learning group.

[*updated 19.02.2018*]

Recommended or required reading:
The course is based on the following textbook and will be supplemented by additional learning material:
Meta Profesional Spanisch für den Beruf, Lehrbuch ISBN: 978-3-12-515460-5

We also recommend these books for grammar:
Uso de la Gramática Española. Nivel Elemental. ISBN 3-12-5358116-6
Spanische Grammatik für Selbstlerner 01 Bd.1 ISBN-10: 3896577093
Tiempo para conjugar. Buch mit CD-Rom, PC, Mac. ISBN 3-12-535809-4

Students will receive a list of recommended teaching and learning materials.

[*updated 30.07.2021*]

Spanish for Beginners II

Module name (EN): Spanish for Beginners II

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SFA2

Hours per semester week / Teaching method:
2SU (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Written examination (final exam)

[*updated 19.02.2018*]

Applicability / Curricular relevance:

E2425 (P200-0023) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 , optional course, non-technical
KI664 (P200-0023) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-SFA2 (P200-0023) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-SFA2 (P200-0023) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.5 (P200-0023) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 6, optional course
MST.SA2 (P620-0569) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course, non-technical
MST.SA2 (P620-0569) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course, non-technical
MST.SA2 (P620-0569) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course, non-technical
PIBWN51 (P200-0023) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific
PIB-SFA2 (P200-0023) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 6, optional course, not informatics specific
PIB-SFA2 (P200-0023) Applied Informatics, Bachelor, SO 01.10.2026 , semester 6, optional course, not informatics specific
MST.SA2 (P620-0569) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 6, optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dr. Julia Frisch

Lecturer: Dr. Julia Frisch

[*updated 13.01.2026*]

Learning outcomes:
The courses Spanish for Beginners I and II are based on each other. In the course of the two modules, students will first reach proficiency level A1 and then advance to level A2 of the European Framework of Reference for Languages.

The course Spanish for Beginners II is aimed at learners with basic knowledge of the Spanish language at level A1 of the European Reference Framework or the module Spanish for Beginners I .

The goal of the course is to provide students with basic knowledge of the Spanish language, which will enable them to communicate in general and professional situations as quickly as possible, both orally and in

writing. To do so, all four skills (speaking, listening comprehension, reading and writing) will be trained equally. Content development will be supported by the repetition of the relevant grammatical structures.

The course takes a communicative and pragmatic approach that particularly promotes communicative competence in job-relevant situations through the use of role playing and situational dialogues. This also includes intercultural aspects that raise the students´ awareness of cultural differences and enable them to assert themselves in specific situations.

[*updated 14.05.2025*]

Module content:
Module content:
In the course Spanish for Beginners II students will learn the lessons 6 to 10 from Meta Profesional A1-A2 (Spanisch für den Beruf, Klett Verlag).

Work
- Describing your private and professional daily routine
- A day at work: habits and time
- Talking about preferences
- Agreeing and objecting to things
- Talking about experiences
- Opening hours
- Organizing a weekly schedule
- Talking about plans

Talking on the telephone
- Making business calls

Business appointments
- Making, accepting and rejecting invitations and suggestions
- Arranging appointments
- Talking about the weather
- Making a hotel reservation
- Planning business meals
- Deciding what is most important at the first meeting with a customer

Products and projects
- Describing buildings and offices
- Assessing and describing products and prices
- Talking about quantities
- Preparing a company presentation

Professional training and experience
- Reading job advertisements
- Composing an application cover letter
- Skills, strengths and weaknesses
- Creating a resume
- Participating in a job interview

In addition, we will concentrate on basic grammatical structures (such as for example, the imperative, future and past of regular and irregular verbs). Students should work on and expand their basic vocabulary independently.

[*updated 14.05.2025*]

Teaching methods/Media:
Teaching and learning materials (print media, slides, audio-visual teaching materials), multimedia learning software compiled specifically for the learning group.

[*updated 19.02.2018*]

Recommended or required reading:
The course is based on the following textbook and will be supplemented by additional learning material:
Meta profesional A1-A2 Spanisch für den Beruf. Klett Verlag; ISBN: 978-3-12-515460-5

We also recommend these books for grammar:

Uso de la Gramática Española. Nivel Elemental. ISBN 3-12-5358116-6
Spanische Grammatik für Selbstlerner 01 Bd.1 ISBN-10: 3896577093
Tiempo para conjugar. Buch mit CD-Rom, PC, Mac. ISBN 3-12-535809-4

Students will receive a list of recommended teaching and learning materials.

[*updated 19.02.2018*]

Sustainable Product Engineering

Module name (EN): Sustainable Product Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SPE

Hours per semester week / Teaching method:
2V+2U (4 hours per week)

ECTS credits:
5

Semester: 4

Mandatory course: no

Language of instruction:
German

Assessment:

[*updated 15.04.2024*]

Applicability / Curricular relevance:

KIB-SPE (P222-0132) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, optional course, technical
KIB-SPE (P222-0132) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, optional course, technical

PIB-SPE (P222-0132) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-SPE (P222-0132) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific
PRI-SPE (P222-0132) Production Informatics, Bachelor, SO 01.10.2023 , semester 4, mandatory course

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Pascal Stoffels

Lecturer: Prof. Dr.-Ing. Pascal Stoffels

[*updated 13.01.2026*]

Learning outcomes:
In this module, students will become familiar with the principle of sustainability. In particular, the ecological effects in the product life cycle will be considered.

By using, for example, the life cycle assessment, system assessment and functional unit, environmental impacts will be described objectively and comparably.

After successfully completing this part of the module, students will be able to evaluate different systems/solutions using appropriate methods and thus support the decision-making process.

[*updated 15.04.2024*]

Module content:
Fundamentals of sustainability, laws and guidelines, life cycle assessment, system assessment, functional unit, assessment methods (life cycle assessment/life cycle assessment, checklists, FMEA, ...), material & process selection from a sustainability perspective

[*updated 15.04.2024*]

Recommended or required reading:

[*updated 15.04.2024*]

Systems Engineering

Module name (EN): Systems Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-SYSE

Hours per semester week / Teaching method:
2V+2PA (4 hours per week)

ECTS credits:
5

Semester: 5

Mandatory course: no

Language of instruction:
German

Assessment:
Project work

[*updated 14.07.2016*]

Applicability / Curricular relevance:

E1572 Electrical Engineering, Bachelor, ASPO 01.10.2012 , semester 5, optional course
KI583 Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technical
KIB-SYSE (P221-0184) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technical
KIB-SYSE (P221-0184) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technical
MAB.4.2.2.18 Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course, technical
PIBWI34 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific
PIB-SYSE (P221-0184) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 5, optional course, informatics specific
PIB-SYSE (P221-0184) Applied Informatics, Bachelor, SO 01.10.2026 , semester 5, optional course, informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Martin Buchholz

Lecturer: Prof. Dr. Martin Buchholz

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be able to transfer an interdisciplinary problem within a complex system and derive a solution using a specific methodology.

[*updated 19.02.2018*]

Module content:
Project worked based on a specific, complex task definition using the methodology learned:
- Requirements analysis and definition
- System design (calculation, simulation, evaluation)
- System integration
- System verification and validation
- Project and risk management
- Sustainable development and optimization

[*updated 19.02.2018*]

Teaching methods/Media:
Coaching during the project

[*updated 14.07.2016*]

Recommended or required reading:
Recommended reading according to project.
Trade journals and data sheets

[*updated 19.02.2018*]

Technical Documentation

Module name (EN): Technical Documentation

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-TDOK

Hours per semester week / Teaching method:
2V (2 hours per week)

ECTS credits:
2

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:

[*updated 14.05.2025*]

Applicability / Curricular relevance:

BMT1580 Biomedical Engineering, Bachelor, ASPO 01.10.2013 , optional course, non-medical/technical
BMT2580.TDO Biomedical Engineering, Bachelor, ASPO 01.10.2018 , optional course, non-medical/technical
BMT2580.TDO Biomedical Engineering, Bachelor, SO 01.10.2025 , optional course, non-medical/technical
E1580 (P200-0024) Electrical Engineering, Bachelor, ASPO 01.10.2012 , optional course, non-technical
KI655 (P200-0024) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, non-technical
KIB-TDOK (P200-0024) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical
KIB-TDOK (P200-0024) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, non-technical
MAB.4.2.1.2 (P200-0024) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013 , semester 5, optional course, not informatics specific, course inactive since 19.08.2021
MST.TDO (P200-0024) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , semester 6, optional course, non-technical
MST.TDO (P200-0024) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , semester 6, optional course, non-technical
MST.TDO (P200-0024) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , semester 6, optional course, non-technical
PIBWN65 (P200-0024) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, not informatics specific
PIB-TDOK (P200-0024) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, not informatics specific
PIB-TDOK (P200-0024) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, not informatics specific
MST.TDO (P200-0024) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011 , semester 6, optional course, non-technical

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 60 hours (equivalent to 2 ECTS credits).
There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Dipl.-Ing. Irmgard Köhler-Uhl

Lecturer: Dipl.-Ing. Irmgard Köhler-Uhl

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will be capable of examining and checking technical texts. They will be able to analyze different kinds of texts based on their target group intentions. The influences of text design will be illustrated and structures for easier text creation will be learned. The documentation of research and work findings, including how to handle quotations and Internet sources, their identification in texts and the creation of a bibliography will enable students to create technical/scientific texts more efficiently.

[*updated 26.02.2018*]

Module content:
1 Text design in standards, guidelines and laws
2 Rules for technical texts
3 Operating instructions
4 Abstracts/text summaries
5 Comprehensibility of texts
6 Business correspondence
7 Notes, transcripts, minutes, reports
8 Structure and numbering of texts
9 Citation rules
10 Bibliography
11 Time management for the creation of longer texts

[*updated 26.02.2018*]

Recommended or required reading:
Lecture notes

[*updated 13.03.2007*]

The Impact of Gender and Diversity on Careers and Studies

Module name (EN): The Impact of Gender and Diversity on Careers and Studies

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-GD

Hours per semester week / Teaching method:
2V+2S (4 hours per week)

ECTS credits:
5

Semester: according to optional course list

Mandatory course: no

Language of instruction:
German

Assessment:
Project (E-portfolio) with presentation (possible as group work)

[*updated 21.12.2023*]

Applicability / Curricular relevance:

KIB-GD (P241-0411) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , optional course, non-technical
KIB-GD (P241-0411) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course, non-technical
MAB_19_4.2.1.31 (P241-0411) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019 , optional course, general subject
MST2.GDB (P241-0411) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course
PIB-GD (P241-0411) Applied Informatics, Bachelor, ASPO 01.10.2022 , optional course, not informatics specific
PIB-GD (P241-0411) Applied Informatics, Bachelor, SO 01.10.2026 , optional course, not informatics specific

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Sandra Wiegand, M.A.

Lecturer: Sandra Wiegand, M.A.

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will understand how gender and diversity influence how personal everyday life, society and science are structured. They will understand the relevance of gender and diversity issues for their studies, future profession, society and their social environment, as well as theories and concepts of diversity, difference and intersectionality. They will be familiar with the different diversity factors (age, ethnic origin & nationality, gender & gender identity, physical & mental abilities, religion & belief, sexual orientation and social origin etc.), as well as their interaction and the associated dominance structures and inequality relations. Students will be able to identify and classify current social issues and the problems resulting from them. They will become familiar with ways of dealing with problems and their possible solutions.

[*updated 22.05.2023*]

Module content:
Cross-faculty topics on diversity and equal opportunities in academic and professional life.

- Managing diversity in organizations

- Intersectionality in the context of gender and diversity
- The legal framework of gender and diversity
- The responsibility of design in society based on the example of gender & diversity
- Gender-sensitive construction
  Dealing with sexual harassment and discrimination
  Diversity as a factor - Inclusion - Opportunities and Challenges
  Gender identity and sexual orientation
  "Social origin" as a diversity dimension, based on the example of students from non-academic families
  Reconciling work and family - parenthood as a diversity dimension
  Diversity and economic success - A contradiction?
  Women at the helm - "How did I end up here?" - Occupational roles and stereotypes using the example of female pilots
  Gender equality in art and culture - How can we counteract the structural inequality suffered by women?
  Effects of study and career choices from a gender perspective

[*updated 22.05.2023*]

Recommended or required reading:
Will be announced in the course.

[*updated 22.05.2023*]

The Impact of Gender and Diversity on Careers and Studies (Submodule)

Module name (EN): The Impact of Gender and Diversity on Careers and Studies (Submodule)

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-GDT

Hours per semester week / Teaching method:
-

ECTS credits:
3

Semester: according to optional course list

Mandatory course: no

Language of instruction:
German

Assessment:
Project work (e-portfolio)

[*updated 19.12.2023*]

Applicability / Curricular relevance:

BMT2583.AGDT (P213-0188) Biomedical Engineering, Bachelor, ASPO 01.10.2018 , semester 5, optional

course
BMT2583.AGDT (P213-0188) Biomedical Engineering, Bachelor, SO 01.10.2025 , semester 5, optional course
EE1640 (P213-0188) Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2022 , optional course, category 2
FT72 Automotive Engineering, Bachelor, ASPO 01.10.2019 , optional course
KIB-GDT (P213-0188) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , optional course
MAB_19_4.2.1.37 (P213-0188) Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019 , optional course
MST2.GDBT (P213-0188) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course
PIB-GDT (P213-0188) Applied Informatics, Bachelor, ASPO 01.10.2022 , optional course
PIB-GDT (P213-0188) Applied Informatics, Bachelor, SO 01.10.2026 , optional course

Workload:
The total student study time for this course is 90 hours.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Sandra Wiegand, M.A.

Lecturer: Sandra Wiegand, M.A.

[*updated 13.01.2026*]

Learning outcomes:

[*updated 19.12.2023*]

Module content:

[*updated 19.12.2023*]

Recommended or required reading:

[*updated 19.12.2023*]

User Experience Engineering

Module name (EN): User Experience Engineering

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-UXE

Hours per semester week / Teaching method:
2V+2U (4 hours per week)

ECTS credits:
5

Semester: 4

Mandatory course: no

Language of instruction:
German

Assessment:
Project with presentation

[*updated 30.06.2024*]

Applicability / Curricular relevance:

KIB-UXE (P221-0204) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 4, optional course, technical
PIB-UXE (P221-0204) Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-UXE (P221-0204) Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific
PRI-UXE Production Informatics, Bachelor, SO 01.10.2023 , semester 4, optional course
PRI-UXE Production Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course

Suitable for exchange students (learning agreement)

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Maximilian Altmeyer

Lecturer: Prof. Dr. Maximilian Altmeyer

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module students will: be able to describe the basic principles of user experience, differentiate these from related concepts such as usability and explain the user-centered design

process. They will be able to explain basic concepts in the field of user research and use them to understand users and the application context and derive user needs. They will have a command of common ideation processes and be able to critically scrutinize ideas with regard to the underlying user needs. The will be able to develop concepts and MVP statements on the basis of user research. They will be familiar with various approaches in the field of UX (especially gamification) and can explain how and why these can enhance the user experience and what dangers need to be considered (dark patterns). They will be able to explain and apply basic concepts of prototyping and discuss the advantages and disadvantages. They will also be able to develop concepts for evaluating interactive systems with regard to their user experience and describe and apply basic qualitative and quantitative empirical methods.

[*updated 28.02.2024*]

Module content:
- User experience, usability, user-centered design process
- Understanding the user and the context of use
- User needs, problem statements, personas, scenarios
- Ideation: Brainstorming, challenge assumptions, design concepts
- Gamification, dark patterns, behavior change and ethical aspects
- MVP statements, business goals
- Prototyping: Low vs. high fidelity prototypes, paper prototypes,
- User testing: Qualitative and quantitative measures of UX

In addition to the lecture, UX methods learned in the exercise will be applied in a kind of workshop. Over the course of the semester, students will work in groups to identify problems through user research (e.g. by interviewing other students on campus), generate ideas, build a minimal prototype and test/evaluate it.

[*updated 28.02.2024*]

Teaching methods/Media:
Workshops, Design Thinking

[*updated 28.02.2024*]

Recommended or required reading:

[*updated 28.02.2024*]

Web Security Project

Module name (EN): Web Security Project

Degree programme: Technical Computer Science, Bachelor, SO 01.10.2026

Module code: TIB-PWS

Hours per semester week / Teaching method:
1V+1PA (2 hours per week)

ECTS credits:
3

Semester: 6

Mandatory course: no

Language of instruction:
German

Assessment:
Project, presentation, documentation

[*updated 12.04.2018*]

Applicability / Curricular relevance:

KI614 (P221-0089) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 6, optional course, technical
KIB-PWS Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, technical
KIB-PWS Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical
PIBWI62 (P221-0089) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific
PIB-PWS Applied Informatics, Bachelor, ASPO 01.10.2022 , semester 4, optional course, informatics specific
PIB-PWS Applied Informatics, Bachelor, SO 01.10.2026 , semester 4, optional course, informatics specific

Workload:
30 class hours (= 22.5 clock hours) over a 15-week period.
The total student study time is 90 hours (equivalent to 3 ECTS credits).
There are therefore 67.5 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Damian Weber

Lecturer: Prof. Dr. Damian Weber

[*updated 13.01.2026*]

Learning outcomes:
After successfully completing this module, students will have learned about typical security holes in web applications.
They know about the effects of such mistakes and how to avoid them in practice.
- Secure development of web applications, getting to know typical target (attack) areas

[*updated 12.04.2018*]

Module content:

- Exemplary implementation of a small application that will be developed during the course of the module. (PHP/SQL/JavaScript)

- Technical and economic impact of exploitable vulnerabilities on the Internet.

- Incident response: My server has been hacked: what do I do if it is already too late?

[*updated 12.04.2018*]

Recommended or required reading:
2011 CWE/SANS Top 25 Most Dangerous Software Errors
Günter Schäfer: Netzsicherheit: Algorithmische Grundlagen und Protokolle, dpunkt.verlag 2003
Risk Management Guide for Information Technology Systems (NIST SP 800-30), 2012
Telekommunikationsgesetz, § 109
Kryptographische Verfahren: Empfehlungen und Schlüssellängen (BSI TR-02102-1), 2017

Module website: https://pws.blackpond.net/

[*updated 12.04.2018*]