

# Course Handbook Computer Science and Communication Systems Bachelor

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Head of Studies	<u>Prof. Dr. Peter Birkner</u>
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## Computer Science and Communication Systems Bachelor - mandatory courses (overview)

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester week / Teaching method</u>	<u>ECTS</u>	<u>Module coordinator</u>
<u>Bachelor Colloquium</u>	KIB-BAK	S222-0006	6	-	3	Studienleitung
<u>Bachelor Thesis</u>	KIB-BAT	T222-0005	6	-	12	Studienleitung
<u>Business Communication and Intercultural Competence</u>	KIB-ENG1	P222-0008	1	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Business Economics</u>	KIB-BWL	P222-0134, P241-0107	1	2V	3	Studienleitung
<u>Communications Technology and Systems 1</u>	KIB-KT1	P222-0019	4	4V	5	<u>Prof. Dr. Horst Wieker</u>
<u>Communications Technology and Systems 2</u>	KIB-KT2	P222-0020	5	4V	5	<u>Prof. Dr. Horst Wieker</u>
<u>Computer Architecture</u>	KIB-RA	P222-0099, P222-0100	3	4V+1P	5	<u>Prof. Dr.-Ing. Jürgen Schäfer</u>
<u>Computer Networks</u>	KIB-RN	P222-0037	3	2V+2P	5	Prof. Dr. Steffen Knapp
<u>Computer Science and Communication Systems Seminar</u>	KIB-SKI	P222-0040	5	2S	3	<u>Prof. Dr. Horst Wieker</u>

<u>Module name</u> <u>(EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester</u> <u>week /</u> <u>Teaching</u> <u>method</u>	<u>ECTS</u>	<u>Module</u> <u>coordinator</u>
<u>Databases</u>	KIB-DB	P222-0009	3	3V+1P	5	<u>Prof. Dr. Klaus</u> <u>Berberich</u>
<u>Distributed</u> <u>Systems</u>	KIB-VS	P221-0005	4	2V+2PA	5	<u>Prof. Dr.</u> <u>Markus Esch</u>
<u>Embedded</u> <u>Systems</u>	KIB-ES	P222-0010	4	2SU+2PA	5	<u>Prof. Dr.-Ing.</u> <u>Jürgen Schäfer</u>
<u>Informatics 1</u>	KIB-INF1	P222-0016	1	2V+2U	5	<u>Prof. Dr.</u> <u>Damian Weber</u>
<u>Informatics 2</u>	KIB-INF2	P222-0017	2	2V+2U	5	<u>Prof. Dr.</u> <u>Damian Weber</u>
<u>Internet</u> <u>Technologies</u>	KIB-INET	P222-0103, P222-0104	5	2V+2P	5	<u>Prof. Dr.</u> <u>Martina</u> <u>Lehser</u>
<u>Introduction to</u> <u>Communications</u> <u>Engineering</u>	KIB-NRTG	P222-0022	2	4V+2P	7	<u>Prof. Dr.</u> <u>Albrecht Kunz</u>
<u>Mathematics 1</u>	KIB-MAT1	P221-0001	1	4V+2U	7	<u>Prof. Dr. Peter</u> <u>Birkner</u>
<u>Mathematics 2</u>	KIB-MAT2	P221-0002	2	3V+1U	5	<u>Prof. Dr. Peter</u> <u>Birkner</u>
<u>Mathematics 3</u>	KIB-MAT3	P222-0002	3	2V+1U	3	<u>Prof. Dr. Peter</u> <u>Birkner</u>
<u>Operating Systems</u>	KIB-BS	P222-0007	3	2V+2P	5	<u>Prof. Dr.</u> <u>Steffen Knapp</u>
<u>Physical and</u> <u>Technical</u> <u>Foundations</u>	KIB-PTG	P222-0023	1	3V+1S	5	<u>Prof. Dr. Horst</u> <u>Wieker</u>
<u>Practical Course:</u> <u>Communication</u> <u>Systems</u>	KIB-PKS	P222-0025	5	4P	5	<u>Prof. Dr. Horst</u> <u>Wieker</u>
<u>Professional</u> <u>Presentations</u>	KIB-ENG3	P222-0028	3	2SU	2	<u>Prof. Dr.</u> <u>Christine Sick</u>

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<b>Hours per semester week / Teaching method</b>	<b>ECTS</b>	<b>Module coordinator</b>
<u>Programming 1</u>	KIB-PRG1	P222-0029	1	4V+2P	8	Dr.-Ing. Eric Wagner
<u>Programming 2</u>	KIB-PRG2	P222-0030	2	4V+2P	8	<u>Prof. Dr.-Ing. Matthias Jung</u>
<u>Programming 3</u>	KIB-PRG3	P222-0031	4	2V+2P	5	<u>Prof. Dr.-Ing. Matthias Jung</u>
<u>Project Management</u>	KIB-PM	P222-0032	2	2V	3	Prof. Dr. Steffen Knapp
<u>Protocols</u>	KIB-PROT	P222-0034, P222-0035	5	4V	5	<u>Prof. Dr. Horst Wieker</u>
<u>Security Engineering</u>	KIB-SE	P222-0039	4	2V+2P	5	<u>Prof. Dr. Damian Weber</u>
<u>Software Engineering</u>	KIB-SWT	P221-0004	3	4V	5	<u>Prof. Dr.-Ing. Martin Burger</u>
<u>Technical Reading and Writing</u>	KIB-ENG2	P222-0043	2	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Theoretical Informatics</u>	KIB-TI	P222-0044	4	4V	5	<u>Prof. Dr. Maximilian Altmeyer</u>
<u>Work Experience Phase</u>	KIB-PRA	S222-0026	6	-	15	Studienleitung

(33 modules)

## Computer Science and Communication Systems Bachelor - optional courses (overview)

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<b>Hours per semester week / Teaching method</b>	<b>ECTS</b>	<b>Module coordinator</b>
<u>.NET Concepts and Tools</u>	KIB-NETW	P221-0096	6	2V+2P	5	<u>Thomas Beckert</u>

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester week / Teaching method</u>	<u>ECTS</u>	<u>Module coordinator</u>
						<u>M.Sc.</u>
<u>"Engineering Visions" Intensive Program</u>	KIB-IPRE	P222-0118	4	3PA+1S	4	<u>Prof. Dr. Martin Löffler-Mang</u>
<u>Applied Computer Science Seminar</u>	KIB-SAI	P221-0092	5	2S	3	<u>Prof. Dr.-Ing. André Miede</u>
<u>Automotive Engineering</u>	KIB-ATEC	P222-0111	6	2V	3	<u>Prof. Dr. Horst Wieker</u>
<u>Basic Principles Governing the Qualification of Trainers and Instructors in Germany's Dual Education and Vocational Training System</u>	KIB-AUSB	P200-0013	6	2V	2	Studiendekan
<u>Brain-Computer Interface</u>	KIB-BCI		-	1V+3PA	6	<u>Prof. Dr. Dr. Daniel Strauß</u>
<u>Broadband Technology and its Applications</u>	KIB-BBTA		6	2V	3	<u>Prof. Dr. Horst Wieker</u>
<u>CAX Basics and Applications</u>	KIB-CAX	P223-0006	3	2V+2U	5	Prof. Dr.-Ing. Pascal Stoffels
<u>Cloud Computing</u>	KIB-CCOM	P221-0066	6	2V+2PA	5	<u>Prof. Dr. Markus Esch</u>
<u>Compiler Construction</u>	KIB-CBAU	P221-0067	5	2V+2P	5	<u>Prof. Dr. Markus Esch</u>
<u>Computer Science and Society Seminar</u>	KIB-SCSS	P221-0128	6	2S	3	<u>Prof. Dr.-Ing. André Miede</u>
<u>Computer Science in the Media</u>	KIB-SIDM		6	2S	3	<u>Prof. Dr. Klaus Berberich</u>

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester week / Teaching method</u>	<u>ECTS</u>	<u>Module coordinator</u>
<u>Computer Vision</u>	KIB-CVIS	P221-0069	6	4V	5	<u>Prof. Dr. Gerald Kroisandt</u>
<u>Design Patterns</u>	KIB-EWM	P221-0075	6	2V	3	<u>Prof. Dr.-Ing. Martin Burger</u>
<u>Digital Signal Processing</u>	KIB-DSIG	P200-0005	5	2V+2P	4	<u>Prof. Dr. Martin Buchholz</u>
<u>Digital Television Technology</u>	KIB-DIGF		6	2V	3	<u>Prof. Dr. Martin Buchholz</u>
<u>Electromobility</u>	KIB-EMOB	P211-0211	6	2V	3	<u>Prof. Dr. Horst Wieker</u>
<u>Embedded Linux</u>	KIB-EMBL		6	2V+2P	4	<u>Dipl.-Inf. Ulrich Bruch</u>
<u>Enterprise Java Beans</u>	KIB-EJB	P221-0105	6	2V+2P	5	<u>Prof. Dr.-Ing. Martin Burger</u>
<u>Error-Identification and Error-Correcting Codes</u>	KIB-FFKC	P222-0115	5	2V	3	<u>Dipl.-Math. Wolfgang Braun</u>
<u>French for Beginners I</u>	KIB-FFA1	P200-0011	5	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>French for Beginners II</u>	KIB-FFA2	P200-0012	6	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>French I</u>	KIB-FRA1	P200-0026	5	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>French II</u>	KIB-FRA2	P241-0295	6	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Functional Programming</u>	KIB-FPRG		6	2V+2P	5	<u>Prof. Dr. Thomas Kretschmer</u>
<u>Future Internet and Smart City with</u>	KIB-FISC	P221-0064	5	4V	5	Prof. Joberto Martins

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester week / Teaching method</u>	<u>ECTS</u>	<u>Module coordinator</u>
<u>Software Defined Networking</u>						
<u>Future Internet: Software Defined Networking</u>	KIB-FSDN		5	4V	4	<u>Prof. Dr. Damian Weber</u>
<u>Game Design and Development</u>	KIB-GDEV	P221-0077	-	2V+2P	5	<u>Prof. Dr.-Ing. André Miede</u>
<u>GUI Programming with Qt</u>	KIB-PRQT	P222-0116	-	4V	5	<u>Hong-Phuc Bui, M.Sc.</u>
<u>Human Computer Interaction</u>	KIB-HCI	P221-0062	5	4V	5	Prof. Steven Frysinger
<u>Industrial Development Processes</u>	KIB-IEP	P212-0090	4	3V+1U	5	<u>Prof. Dr. Kai Haake</u>
<u>Industrial Ecology</u>	KIB-INEC	P241-0162	6	4V	5	Prof. Steven Frysinger
<u>Information Retrieval</u>	KIB-IRET		5	2V+2PA	5	<u>Prof. Dr. Klaus Berberich</u>
<u>Information Security</u>	KIB-ISEC	P221-0063	5	2V	3	<u>Prof. Dr. Damian Weber</u>
<u>Intercultural Communication</u>	KIB-INTK		6	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Internet and the Law</u>	KIB-REII	P221-0061	5	2V	2	<u>RA Cordula Hildebrandt</u>
<u>Internet Development with Java 1</u>	KIB-IJA1	P221-0081	5	2V+2P	5	<u>Dipl.-Inf. Christopher Olbertz</u>
<u>Internet Development with Java 2</u>	KIB-IJA2		6	2V+2P	5	<u>Dipl.-Inf. Christopher Olbertz</u>
<u>Introduction to Astronomy</u>	KIB-ASTR	P200-0008	5	2V	2	<u>Prof. Dr. Martin</u>

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						<u>Löffler-Mang</u>
<u>Introduction to Parallel Programming with CUDA</u>	KIB-CUDA	P222-0074	5	1V+1P	3	<u>Dipl.-Inform. Marion Bohr</u>
<u>Introduction to Single-Board Computers</u>	KIB-EE	P221-0071	-	2V+2PA	5	<u>Prof. Dr. Peter Birkner</u>
<u>Introduction to Wireless LANs</u>	KIB-WLAN	P200-0033	6	2V	3	<u>Dipl.-Math. Wolfgang Braun</u>
<u>IT Forensics</u>	KIB-ITF		5	1V+1P	2	<u>Prof. Dr. Damian Weber</u>
<u>IT Forensics Practical Course</u>	KIB-ITFP		6	2P	3	<u>Prof. Dr. Damian Weber</u>
<u>IT Security Project</u>	KIB-PITS	P221-0088	5	4PA	5	<u>Prof. Dr. Damian Weber</u>
<u>Kinematic Principles of Robotics</u>	KIB-KGR	P221-0197	5	3V+1U	5	<u>Prof. Dr. Michael Kleer</u>
<u>Law for Business Founders</u>	KIB-REXG		6	2V	2	<u>RA Cordula Hildebrandt</u>
<u>Machine Learning</u>	KIB-MLRN	P221-0085	6	2V+2U	5	<u>Prof. Dr. Klaus Berberich</u>
<u>Mathematical Software Systems and Algorithmic Applications</u>	KIB-MSAA		5	4V	5	<u>Prof. Dr. Barbara Grabowski</u>
<u>Measurements and Simulations in Communications Engineering</u>	KIB-MSNT		6	2V+2P	5	<u>Prof. Dr. Albrecht Kunz</u>

<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester week / Teaching method</u>	<u>ECTS</u>	<u>Module coordinator</u>
<u>Mentoring</u>	KIB-MENT	P200-0018	5	2S	2	<u>Prof. Dr. Simone Odierna</u>
<u>Methods and Applications from the Field of Artificial Intelligence for Signal and Image Processing</u>	KIB-KISB		-	4PA	5	<u>Prof. Dr.-Ing. Ahmad Osman</u>
<u>Mobile Application Development (Android)</u>	KIB-MADA		5	2V+2P	5	<u>Christoph Karls, M.Sc.</u>
<u>Numerical Software</u>	KIB-NUMS	P221-0087	-	2V+2PA	5	<u>Prof. Dr. Gerald Kroisandt</u>
<u>Preparing for the IELTS Test</u>	KIB-IEL		6	2VU	2	<u>Prof. Dr. Christine Sick</u>
<u>Presenting a Project</u>	KIB-SSP		6	2V	2	<u>Prof. Dr. Christine Sick</u>
<u>Principles of Web Development</u>	KIB-WEB	P221-0023	5	2V+2U	5	<u>Prof. Dr. Maximilian Altmeyer</u>
<u>Programming Tools</u>	KIB-PRGW		6	2V+2P	5	<u>Prof. Dr. Reinhard Brocks</u>
<u>Risk-Based Decision Making and Statistical Data Analysis</u>	KIB-ERSD	P221-0107	5	2V+2P	4	<u>Melanie Kaspar, M.Sc.</u>
<u>Robotics Lab Course</u>	KIB-ROBP		6	2P	4	<u>Dipl.-Ing. Dirk Ammon</u>
<u>Ruby on Rails</u>	KIB-RUBY		6	3V+1P	4	<u>Dipl.-Inf. Julian Fischer</u>
<u>Running RoboNight Workshops</u>	KIB-ROBO	P221-0182	6	1PA+1S	3	<u>Prof. Dr. Steffen Knapp</u>



<u>Module name (EN)</u>	<u>Code</u>	<u>SAP-P</u>	<u>Semester</u>	<u>Hours per semester week / Teaching method</u>	<u>ECTS</u>	<u>Module coordinator</u>
<u>Russian for Beginners 1</u>	KIB-RFA1	P200-0020	6	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Russian for Beginners 2</u>	KIB-RFA2	P200-0021	6	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Semiconductor Technology and Production</u>	KIB-HLTP		6	4V	5	<u>Prof. Dr. Albrecht Kunz</u>
<u>Sino-German Student Club for Smart Sensors</u>	KIB-SGSC	P221-0131	6	1V+3PA	5	<u>Prof. Dr. Martina Lehser</u>
<u>Software Development for Collaborative Industrial Robots</u>	KIB-IROB	P221-0132	5	4PA	5	Prof. Dr. Steffen Knapp
<u>Spanish for Beginners I</u>	KIB-SFA1	P200-0022	5	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Spanish for Beginners II</u>	KIB-SFA2	P200-0023	6	2SU	2	<u>Prof. Dr. Christine Sick</u>
<u>Systems Engineering</u>	KIB-SYSE	P221-0184	5	2V+2PA	5	<u>Prof. Dr. Martin Buchholz</u>
<u>Technical Documentation</u>	KIB-TDOK	P200-0024	6	2V	2	<u>Dipl.-Ing. Irmgard Köhler-Uhl</u>
<u>The Impact of Gender and Diversity on Careers and Studies</u>	KIB-GD	P241-0411	-	2V+2S	5	Sandra Wiegand, M.A.
<u>The Impact of Gender and Diversity on Careers and Studies (Submodule)</u>	KIB-GDT	P213-0188	-	-	3	Sandra Wiegand, M.A.
<u>Web Security Project</u>	KIB-PWS		6	1V+1PA	3	<u>Prof. Dr. Damian Weber</u>

(74 modules)

# Computer Science and Communication Systems Bachelor - mandatory courses

## Bachelor Colloquium

<b>Module name (EN):</b> Bachelor Colloquium
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-BAK
<b>Hours per semester week / Teaching method:</b> -
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Oral presentation  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  DFIW-BK (S610-0212) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019</u> , semester 6, mandatory course KIB-BAK (S222-0006) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, mandatory course KIB-BAK (S222-0006) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, mandatory course PIB-BK (S221-0010) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 6, mandatory course PRI-BK (S223-0001) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 6, mandatory course
<b>Workload:</b> The total student study time for this course is 90 hours.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>

<p><b>Module coordinator:</b> Studienleitung</p>
<p><b>Lecturer:</b> Studienleitung</p> <p><i>[updated 01.10.2022]</i></p>
<p><b>Learning outcomes:</b> Students</p> <ul style="list-style-type: none"> <li>_ will be able to analyze comprehensive material independently.</li> <li>_ will be able to summarize complex interrelationships and present them in a professional manner.</li> <li>_ will also be able to answer more detailed questions on the subject areas of their Bachelor thesis competently.</li> </ul> <p><i>[updated 26.02.2018]</i></p>
<p><b>Module content:</b> The goal of the Bachelor colloquium is to present and explain the results and content of the Bachelor thesis orally and to verify that the work was done independently.</p> <p><i>[updated 26.02.2018]</i></p>
<p><b>Recommended or required reading:</b> Literature listed in the respective Bachelor thesis.</p> <p><i>[updated 26.02.2018]</i></p>

## Bachelor Thesis

<p><b>Module name (EN):</b> Bachelor Thesis</p>
<p><b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u></p>
<p><b>Module code:</b> KIB-BAT</p>
<p><b>Hours per semester week / Teaching method:</b> -</p>
<p><b>ECTS credits:</b> 12</p>
<p><b>Semester:</b> 6</p>
<p><b>Mandatory course:</b> yes</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Written composition</p>

[updated 26.02.2018]

**Applicability / Curricular relevance:**

DFIW-BT (T610-0211) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 6, mandatory course

KIB-BAT (T222-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, mandatory course

KIB-BAT (T222-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, mandatory course

PIB-BT (T221-0008) Applied Informatics, Bachelor, ASPO 01.10.2017 , semester 6, mandatory course

PRI-BT (T223-0001) Production Informatics, Bachelor, ASPO 01.10.2023 , semester 6, mandatory course

**Workload:**

The total student study time for this course is 360 hours.

**Recommended prerequisites (modules):**

None.

**Recommended as prerequisite for:**

**Module coordinator:**

Studienleitung

**Lecturer:** Studienleitung

[updated 01.10.2022]

**Learning outcomes:**

Students

\_ will be able to work independently on given (medium to difficult) subject-specific tasks within a given period of time using scientific methods.

\_ will be capable of using the specialist knowledge and methods acquired during their studies to develop ways to select suitable solutions in a goal- and result-oriented manner.

\_ will be able to analyze topics in cooperation with external and internal clients and colleagues, conceive their solution and implement them accordingly.

And lastly, students will be able to document the results of their work in writing according to scientific principles.

[updated 26.02.2018]

**Module content:**

The Bachelor thesis is a project from the field of research, industry or business. It is of a theoretical, programming, empirical and/or experimental nature. Students must document their thesis (or collaboration) in the project. The application-oriented, industrial project aspect (project plan, project implementation, project result) of the thesis will be taken into account.

[updated 26.02.2018]

**Recommended or required reading:**

Will be specified by the supervisor resp. researched independently based on a specific topic.

[updated 26.02.2018]

# Business Communication and Intercultural Competence

<b>Module name (EN): Business Communication and Intercultural Competence</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ENG1
<b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 1
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> English/German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-ENG1 (P222-0008) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 1, mandatory course KIB-ENG1 (P222-0008) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 1, mandatory course PIB-EN1 (P221-0017) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 1, mandatory course PRI-BCO (P223-0007) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 1, mandatory course  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b> <u>KIB-ENG2</u> Technical Reading and Writing <u>KIB-ENG3</u> Professional Presentations  [updated 01.10.2022]

**Module coordinator:**  
Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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 "Business Communication and Intercultural Competence" module:

After successfully completing this module, students will have received insight into the differences in international working environments, especially in English-language working environments, and can describe professional tasks. They will be able to recognize potential difficulties and conflicts in intercultural communication situations and can draw conclusions for their own behaviour in international contexts. In this context, they will be able to use adequate means of speech and behaviour for specific oral communication situations. In addition, they will be sensitized to different language registers and can apply them adequately in given written communication situations with international business partners.

[updated 12.04.2018]

**Module content:**

- Greetings, introductions and small talk
- Describing job-related tasks
- Making phone calls in a professional context
- Correspondence with business partners

In addition, we will work on:

- Vocabulary
- Repeating relevant grammatical structures
- Raising awareness for functional language use
- Intercultural aspects

[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:

Susanne Ley, Christine Sick: prep course English in m&eLanguageLearningPortal@CAS (e- and mobile learning offer to support students in English language learning at the Alt-Saarbrücken campus of the htw

saar, Niveau A1-B1)

Christine Sick (2015): TechnoPlus Englisch VocabApp (Mobile-Learning-Angebot insbesondere zum Grundwortschatz, alle Niveaustufen), 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 19.02.2018]

**Module offered in:**  
WS 2023/24

## Business Economics

<b>Module name (EN): Business Economics</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-BWL
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 1
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-BWL (P222-0134, P241-0107) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 1, mandatory course KIB-BWL (P222-0134, P241-0107) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 1, mandatory course
<b>Workload:</b> 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.

<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> Studienleitung</p>
<p><b>Lecturer:</b> Studienleitung  [updated 01.10.2022]</p>
<p><b>Learning outcomes:</b> Knowledge in business economics is the basis for the analysis, development and adaptation of organizations and the systems used in them. The objective of this lecture is to convey essential knowledge about business administration. The comprehensiveness and depth of the selected topics are oriented on the requirements currently placed on students taking part in application-oriented study programs.</p> <p>An additional objective is to provide students with a deeper insight into the core operational processes of a company and the resulting organizational and decision-making problems. To do so, students will acquire a systematic basic understanding of economic interrelationships. They will be given an overview of the relevant production factors and will study the closed loop of resource planning necessary for their efficient use.</p> <p>The interrelationships between the IT sector and computer science will be established and clarified based on core processes.</p> <p>[updated 19.02.2018]</p>
<p><b>Module content:</b></p> <ol style="list-style-type: none"> <li>1. Production factors</li> <li>2. Companies</li> <li>3. Circular flow of income</li> <li>4. Legal entities</li> <li>5. Goals (incl. key figures)</li> <li>6. Human resources</li> <li>7. Service provision</li> <li>8. Cost accounting</li> <li>9. Accounting</li> <li>10. Business processes</li> <li>11. Special IT systems (e.g. CRM)</li> </ol> <p>[updated 19.02.2018]</p>
<p><b>Teaching methods/Media:</b> PowerPoint presentations, exercises</p> <p>[updated 19.02.2018]</p>
<p><b>Recommended or required reading:</b> Wöhe, Günter: Einführung in die Allgemeine Betriebswirtschaftslehre Verlag Vahlen</p>



Thommen, Jean-Paul/ Achleitner, Ann-Kristin  
Allgemeine Betriebswirtschaftslehre - Umfassende Einführung aus managementorientierter Sicht  
Verlag Springer Gabler

Bierle, Klaus:  
Grundlagen der BWL  
ALPHA-Verlag

Gadatsch, Andreas:  
Grundkurs Geschäftsprozess-Management  
Methoden und Werkzeuge für die IT-Praxis: Eine Einführung für Studenten und Praktiker  
Verlag Vieweg + Teubner

[updated 19.02.2018]

**Module offered in:**  
WS 2023/24

## Communications Technology and Systems 1

<b>Module name (EN):</b> Communications Technology and Systems 1
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-KT1
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 4
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-KT1 (P222-0019) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 4, mandatory course KIB-KT1 (P222-0019) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 4, mandatory course
<b>Workload:</b>

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:**

KIB-KT2 Communications Technology and Systems 2

KIB-PKS Practical Course: Communication Systems

KIB-PROT Protocols

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr. Horst Wieker

**Lecturer:** Prof. Dr. Horst Wieker

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will have comprehensive knowledge of communication technology. They will be familiar with the structure of different communication networks. They will be able to characterize the technical components and their resp. functions within the network and apply this knowledge to solving networking issues. Lastly, students will be capable of recognizing the presented concepts in modern communication technologies.

[updated 26.02.2018]

**Module content:**

- \* Overview of communication networks
  - Architectures
  - Components
  - Sequence of actions and their functions
- \* Access networks
  - ISDN
- \* Core networks
  - Signaling (SS7)
  - Data transmission

[updated 26.02.2018]

**Recommended or required reading:**

SIGMUND G., Technik der Netze, Hüthing

AHRENS P, ATM Basics \_ die Grundkonzepte des Asynchronous Transfer Mode, Schlembach, J

SIGMUND G., ATM \_ die Technik, Hüthing

[updated 26.02.2018]

## Communications Technology and Systems 2

<b>Module name (EN):</b> Communications Technology and Systems 2
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-KT2
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-KT2 (P222-0020) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, mandatory course KIB-KT2 (P222-0020) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> <u>KIB-KT1</u> Communications Technology and Systems 1  [updated 01.10.2022]
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Horst Wieker</u>

**Lecturer:** Prof. Dr. Horst Wierer

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will have advanced knowledge of communication networks. Students will be able to understand the functionalities of the technologies presented in detail and apply them in real scenarios. Students will understand the development processes of the technologies presented, enabling them to understand new concepts more easily and shape them.

[updated 26.02.2018]

**Module content:**

- \* LAN/WAN technologies
- \* Next Generation Networks
- \* VoIP
- \* SDH
- \* Mobile communications

[updated 26.02.2018]

**Recommended or required reading:**

KIEFER R., DWDM, SDH & Co. : Technik und Troubleshooting in optischen Netzen, Hüthig  
KIEFER R., Digitale Übertragung in SDH- und PDH-Netzen, expert  
SAUTER M., Grundkurs Mobile Kommunikationssysteme, Springer

[updated 26.02.2018]

**Module offered in:**

WS 2023/24

## Computer Architecture

**Module name (EN):** Computer Architecture

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-RA

**Hours per semester week / Teaching method:**

4V+1P (5 hours per week)

**ECTS credits:**

5

**Semester:** 3

**Mandatory course:** yes

<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b></p> <p><i>[still undocumented]</i></p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KIB-RA (P222-0099, P222-0100) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 3, mandatory course  KIB-RA (P222-0099, P222-0100) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 3, mandatory course</p>
<p><b>Workload:</b></p> <p>75 class hours (= 56.25 clock hours) over a 15-week period.  The total student study time is 150 hours (equivalent to 5 ECTS credits).  There are therefore 93.75 hours available for class preparation and follow-up work and exam preparation.</p>
<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> <u>Prof. Dr.-Ing. Jürgen Schäfer</u></p>
<p><b>Lecturer:</b> <u>Prof. Dr.-Ing. Jürgen Schäfer</u></p> <p><i>[updated 01.10.2022]</i></p>
<p><b>Learning outcomes:</b></p> <p>After successfully completing this module, students will be able to understand, analyze and design digital circuits (switching networks, switching devices). Important applications, especially from the field of computer technology, will be elaborated on and developed during this practical course.</p> <p>Students will learn how digital computers are structured, organized and how they operate. The architectural elements of a computer will be discussed at register level and brought together to form a sample architecture. By understanding command processing, addressing techniques and concepts such as pipeline and cache, students will be able to understand modern computer architectures.</p> <p><i>[updated 26.02.2018]</i></p>
<p><b>Module content:</b></p> <p>Part I:</p> <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Combinational circuits <ol style="list-style-type: none"> <li>2.1 Basics</li> <li>2.2 Normal forms</li> <li>2.3 Minimization of switching functions</li> <li>2.4 Examples</li> </ol> </li> <li>3. Sequential circuits</li> </ol>

- 3.1 Flip flops
- 3.2 Registers, shift registers
- 3.3 Counters
- 3.4 Examples

Part II:

- 1. Representing numbers in the computer
- 2. Von Neumann architecture
- 3. Memory components
- 4. Sequential control
- 5. Microprogramming
- 6. Instruction set architecture
- 7. Interrupt handling
- 8. RISC processors
- 9. Pipelining
- 10. Cache

[updated 26.02.2018]

**Recommended or required reading:**

Part I:

- Borgmeyer: Grundlagen der Digitaltechnik, Hanser-Verlag, 2001
- Borucki: Grundlagen der Digitaltechnik, Teubner-Verlag, 2000
- Beuth: Digitaltechnik, Vogel Verlag, 2003
- Urbanski: Digitaltechnik, Springer Verlag, 2004

Part II:

- W. Schiffmann, R. Schmitz: Technische Informatik 2, Springer-Verlag, Berlin, 1999
- K. Wüst, Mikroprozessortechnik, Vieweg-Verlag, Braunschweig, 2003
- H. Malz, Rechnerarchitektur, Vieweg-Verlag, Braunschweig, 2004
- J. L. Hennessy, D. A. Patterson: Rechnerarchitektur Analyse, Entwurf, Implementierung und Bewertung, Vieweg-Verlag, Braunschweig, 2004
- P. Herrmann : Rechnerarchitektur \_ Aufbau Organisation und Implementierung, Vieweg-Verlag, Braunschweig, 2000

[updated 26.02.2018]

**Module offered in:**

WS 2023/24

## Computer Networks

**Module name (EN):** Computer Networks

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-RN

**Hours per semester week / Teaching method:**

2V+2P (4 hours per week)

<p><b>ECTS credits:</b> 5</p>
<p><b>Semester:</b> 3</p>
<p><b>Mandatory course:</b> yes</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Written exam</p> <p>[updated 26.02.2018]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>BMT2551.RN <u>Biomedical Engineering, Bachelor, ASPO 01.10.2018</u> , optional course, medical/technical  DFIW-RN (P610-0192) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019</u> , semester 4, mandatory course  KIB-RN (P222-0037) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 3, mandatory course  KIB-RN (P222-0037) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 3, mandatory course  PIB-RN (P221-0038) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, mandatory course  PRI-RN (P222-0037) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 3, mandatory course</p>
<p><b>Workload:</b> 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.</p>
<p><b>Recommended prerequisites (modules):</b> <u>KIB-INF1</u> Informatics 1 <u>KIB-INF2</u> Informatics 2</p> <p>[updated 01.10.2022]</p>
<p><b>Recommended as prerequisite for:</b> <u>KIB-FISC</u> Future Internet and Smart City with Software Defined Networking <u>KIB-INET</u> Internet Technologies <u>KIB-PROT</u> Protocols <u>KIB-VS</u> Distributed Systems</p> <p>[updated 01.10.2022]</p>
<p><b>Module coordinator:</b> Prof. Dr. Steffen Knapp</p>
<p><b>Lecturer:</b> Prof. Dr. Steffen Knapp</p>

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will be familiar with the functionality and data structures of the basic Internet protocol families between LAN and application level. They will be able to describe the communication in a TCP/IP computer network and use this knowledge for troubleshooting.

[updated 26.02.2018]

**Module content:**

1. Computer communication
  - 1.1. Models
  - 1.2. LAN
  - 1.3. IP/ICMP
  - 1.4. UDP
  - 1.5. TCP
2. Selected application layer Internet protocols
3. Using network tools

[updated 26.02.2018]

**Recommended or required reading:**

Kurose, Ross, Computernetzwerke, Pearson, 2012  
D. Comer, Computer Networks and Internets: Global Edition, Pearson, 2015

[updated 26.02.2018]

**Module offered in:**

WS 2023/24

## Computer Science and Communication Systems Seminar

**Module name (EN):** Computer Science and Communication Systems Seminar

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-SKI

**Hours per semester week / Teaching method:**

2S (2 hours per week)

**ECTS credits:**

3

**Semester:** 5

**Mandatory course:** yes

**Language of instruction:**



German
<p><b>Assessment:</b> Seminar presentation</p> <p>[updated 26.02.2018]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KIB-SKI (P222-0040) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, mandatory course  KIB-SKI (P222-0040) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, mandatory course</p>
<p><b>Workload:</b> 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.</p>
<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> <u>Prof. Dr. Horst Wiekler</u></p>
<p><b>Lecturer:</b> <u>Prof. Dr. Horst Wiekler</u></p> <p>[updated 01.10.2022]</p>
<p><b>Learning outcomes:</b> After successfully completing this module, students will understand new technologies and be able to use them to advantage in solutions for communication applications. The social implications of the new technologies will be recorded and taken into account in future projects.</p> <p>[updated 26.02.2018]</p>
<p><b>Module content:</b> Seminar topics (will be announced at the beginning of the semester)</p> <p>[updated 26.02.2018]</p>
<p><b>Recommended or required reading:</b> Journal articles on new communication technologies</p> <p>[updated 26.02.2018]</p>
<p><b>Module offered in:</b> WS 2023/24</p>

# Databases

<b>Module name (EN): Databases</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-DB
<b>Hours per semester week / Teaching method:</b> 3V+1P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 3
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  DFBI-323 (P610-0219) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018</u> , semester 3, mandatory course DFIW-DB (P610-0183) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019</u> , semester 3, mandatory course KIB-DB (P222-0009) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 3, mandatory course KIB-DB (P222-0009) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 3, mandatory course PIB-DB (P221-0018) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 3, mandatory course PRI-DB (P222-0009) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 3, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b> <u>KIB-INET</u> Internet Technologies  [updated 01.10.2022]

**Module coordinator:**  
Prof. Dr. Klaus Berberich

**Lecturer:** Prof. Dr. Klaus Berberich

[updated 01.10.2022]

**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 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 19.02.2018]

**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. NoSQL

[updated 19.02.2018]

**Teaching methods/Media:**

Transparencies, script, example databases in SQLite and Microsoft SQL Server, practical and theoretical exercises.

[updated 19.02.2018]

**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, 2013

Wiese Lena: Advanced Data Management, De Gruyter, 2015

[updated 19.02.2018]

**Module offered in:**

WS 2023/24

## Distributed Systems

**Module name (EN):** Distributed Systems

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-VS

**Hours per semester week / Teaching method:**

2V+2PA (4 hours per week)

**ECTS credits:**

5

**Semester:** 4

**Mandatory course:** yes

**Language of instruction:**

German

**Assessment:**

[still undocumented]

**Applicability / Curricular relevance:**

KIB-VS (P221-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, mandatory course

KIB-VS (P221-0005) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , 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):**

KIB-PM Project Management

KIB-PRG2 Programming 2

KIB-RN Computer Networks

[updated 01.10.2022]

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Dr. Markus Esch

**Lecturer:** Prof. Dr. Markus Esch

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this module, students will be able to name the properties of distributed systems and will be able to describe important concepts of distributed systems. They will be able to recognize the inherent complexity of distributed systems and the importance of protocol definitions and architectures at application level.

Students will be able to apply common programming techniques and current technologies for the development of distributed systems. In addition, they will be capable of analyzing the properties of different architectural approaches against the background of the requirements for a distributed system and of deriving approaches from them independently.

Through project work, students will be able apply project management methods in project groups of up to six people.

[updated 19.02.2018]

**Module content:**

- Characteristics of distributed systems
- Architecture of distributed systems
- Interprocess communication in distributed systems
  - o Client/server programming
  - o Socket programming
  - o Remote procedure calls
  - o Java RMI
  - o SOAP web services
  - o REST web services
- Error tolerance

[updated 19.02.2018]

**Teaching methods/Media:**

Lecture slides, annotated lecture slides as a script, program examples, project work

[updated 19.02.2018]

**Recommended or required reading:**

A. S. TANNENBAUM, M. v. STEEN: Distributed Systems. Principles and Paradigms, CreateSpace Independent Publishing Platform, 2nd Edition, 2016

G. COULOURIS, J. DOLLIMORE, T. KINDBERG: Distributed Systems: Concepts and Design, 5th Edition, 2011

A. SCHILL, T. SPRINGER: Verteilte Systeme: Grundlagen und Basistechnologien, Springer, 2012

G. BENGEL: Grundkurs Verteilte Systeme, Springer, 2014

M. ZAHN: Unix-Netzwerkprogrammierung mit Threads, Sockets und SSL, Springer, 2006

D. ABTS: Masterkurs Client/Server-Programmierung mit Java, Springer, 2015

[updated 19.02.2018]

## Embedded Systems

<b>Module name (EN): Embedded Systems</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ES
<b>Hours per semester week / Teaching method:</b> 2SU+2PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 4
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b>  <i>[still undocumented]</i>
<b>Applicability / Curricular relevance:</b>  KIB-ES (P222-0010) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 4, mandatory course KIB-ES (P222-0010) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 4, mandatory course
<b>Workload:</b> 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 01.10.2022]

**Learning outcomes:**

**Proficiency:** After successfully completing this module, students will be proficient in the following: structure of components of embedded systems, system-on-chip, special features of embedded system programming (cross-compiler, programming, debugging; GPIO, ADC, DAC, SPI, I2C, USART interfaces; interrupts and exceptions)

**Skills:** Furthermore, students will be capable of working with a development tool for embedded systems, working with the documentation of a modern RISC microcontroller and configuring GPIOs, USART interfaces and timers, as well as creating interrupts.  
Programs, debugging embedded systems.

**Competencies:** Students will also be able to program microcontroller-based embedded systems with limited resources under real-time conditions without an operating system. They will be able to implement simple hardware abstraction layers and realize simple controls using state machines. Students will be able to detect possible race conditions.

[updated 26.02.2018]

**Module content:**

1. Software development tools
  - Programming environment  $\mu$ Vision (MDK-ARM)
  - Project settings
  - Compilers, linkers
  - Debugging
2. Microcontrollers
  - Architecture
  - ISA
  - Interrupts
3. Concurrency
  - Problems
  - Possible solutions
4. Hardware abstraction layers (HAL)
5. Practical applications
  - IO pins: Input and output
  - Abstract implementation of a communication interface based on an interface for receiving and sending data via an asynchronous (USART) and synchronous (SPI or I2C) serial interface.
  - Use of callback methods in connection with interrupts (inversion of control)
  - Time control via timer, PWM generation and analysis

[updated 26.02.2018]

**Recommended or required reading:**

Jospeh Yiu: "The Definite Guide to the ARM Cortex-M3", Newnes  
Bruce P. Douglass: "Design Patterns for Embedded Systems in C", Newnes  
Daniel W. Lewis: "Fundamentals of Embedded Software with the ARM Cortex-M3", Pearson International Ed.  
Thomas Eißenlöffel: "Embedded-Software entwickeln", dpunkt.verlag  
J. A. Langbridge: Professional Embedded ARM Development, John Wiley & Sons, 2014  
W. Hohl: "ARM Assembly Language - Fundamentals and Techniques", CRC Press, 2009  
ST: "RM0008 Reference Manual", www.st.com  
ARM: "ARM Compiler toolchain, Compiler Reference", <http://infocenter.arm.com/help>  
ARM: "ARM Compiler toolchain, Using the Compiler", <http://infocenter.arm.com/help>

[updated 26.02.2018]

## Informatics 1

<b>Module name (EN): Informatics 1</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-INF1
<b>Hours per semester week / Teaching method:</b> 2V+2U (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 1
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-INF1 (P222-0016) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 1, mandatory course KIB-INF1 (P222-0016) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 1, mandatory course PRI-INF1 (P222-0016) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 1, mandatory course
<b>Workload:</b>



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:**

KIB-INF2 Informatics 2

KIB-RN Computer Networks

KIB-SDSA Simulation of Discrete Systems with AnyLogic

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr. Damian Weber

**Lecturer:** Prof. Dr. Damian Weber

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will be able to use the basic concepts of algorithms and data structures in a targeted manner.

They will understand the representation of data in a computer and can use it in data structures to solve problems. Through the use of a Random Access Machine machine model they will gain become acquainted with the basic operations a computer can perform. They will be able to accurately express problems and analyze simple algorithmic problems to develop solutions. They will be able to asymptotically estimate the effort required for the solution.

The related techniques will be learned and intensified in theoretical training sessions by means of independent work.

[updated 19.02.2018]

**Module content:**

1. Mathematic principles

1.1 Number systems

1.2 Boolean algebra

2. Random Access Machine machine model

2.1 Structure

2.2 Program correctness

2.3 Program runtime

3. Data structures

3.1 Arrays

3.2 Lists

3.3 Heaps

3.4 Hash tables

3.5 Search trees

4. Algorithms

4.1 High-level programming languages  
4.2 Recursion  
4.3 Sorting

[updated 19.02.2018]

**Teaching methods/Media:**

RAMses, a RAM simulator

[updated 19.02.2018]

**Recommended or required reading:**

Cormen Th., Leiserson Ch., Rivest R., Introduction to Algorithms, Oldenbourg, 2013  
Sedgewick R., Wayne K., Algorithmen und Datenstrukturen, Pearson Studium, 2014

[updated 19.02.2018]

**Module offered in:**

WS 2023/24

## Informatics 2

**Module name (EN): Informatics 2**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-INF2

**Hours per semester week / Teaching method:**

2V+2U (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-INF2 (P222-0017) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 ,  
semester 2, mandatory course

KIB-INF2 (P222-0017) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 ,

semester 2, mandatory course  
PRI-INF2 (P222-0017) Production Informatics, Bachelor, ASPO 01.10.2023 , 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):**

KIB-INF1 Informatics 1  
KIB-MAT1 Mathematics 1

[updated 01.10.2022]

**Recommended as prerequisite for:**

KIB-RN Computer Networks  
KIB-SDSA Simulation of Discrete Systems with AnyLogic

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr. Damian Weber

**Lecturer:** Prof. Dr. Damian Weber

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will understand the formulation of different algorithmic problems as a graph problem.

Students will be able to solve graph problems algorithmically. The knowledge about data structures and basic algorithmic techniques acquired in the course "Informatics 1" will be applied to solve these problems. In this way, students will acquire the skills required to analyze more complex algorithms.

Finally, an intuitive introduction to important complexity classes will provide the basis for understanding the algorithmic solvability of problems. The approaches of Greedy algorithms and dynamic programming will be understood as techniques for solving difficult algorithmic problems approximately and efficiently. By analyzing the consumption of resources, students will be able to decide for individual problems whether efficient, exact or heuristic procedures are available for solving them.

[updated 26.02.2018]

**Module content:**

1. Graphs
  - 1.1 Data structures
  - 1.2 Basic algorithms
  - 1.3 Shortest paths
  - 1.4 Connected components
2. Problem solving techniques

- 2.1 Dynamic programming
- 2.2 Greedy algorithms
- 2.3 Analytical techniques of approximate methods

[updated 19.02.2018]

**Teaching methods/Media:**

[updated 19.02.2018]

**Recommended or required reading:**

Cormen Th., Leiserson Ch., Rivest R., Introduction to Algorithms, Oldenbourg, 2013  
 Sedgewick R., Wayne K., Algorithmen und Datenstrukturen, Pearson Studium, 2014

[updated 19.02.2018]

## Internet Technologies

**Module name (EN): Internet Technologies**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-INET

**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:**  
 Project and presentation

[updated 19.02.2018]

**Applicability / Curricular relevance:**

KIB-INET (P222-0103, P222-0104) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021, semester 5, mandatory course  
 KIB-INET (P222-0103, P222-0104) Computer Science and Communication Systems, Bachelor, ASPO

01.10.2022 , semester 5, mandatory course

PIB-INET (P222-0103, P222-0104) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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):**

KIB-DB Databases

KIB-RN Computer Networks

[updated 01.10.2022]

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Dr. Martina Lehser

**Lecturer:** Prof. Dr. Martina Lehser

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will understand the basic concepts and technologies in the internet environment and their suitability and use in the development of web-based information systems. Students will be able to create an Internet application based on a larger project. This will enable them to design and implement more complex Internet applications using the appropriate tools.

[updated 26.02.2018]

**Module content:**

1. Basics
2. HTML, CSS, Javascript basics
3. Client-side page generation (Ajax, JSON, jQuery, Google Maps, Bootstrap, AngularJS, Three.js)
4. Server-side page generation (based on ASP. NET / umbraco)

[updated 19.02.2018]

**Teaching methods/Media:**

Practical applications in the computer lab with a projector, server access

[updated 19.02.2018]

**Recommended or required reading:**

Web developer site: <http://www.w3schools.com/>

jQuery: <https://jquery.com/>

Bootstrap framework: <http://getbootstrap.com/>

ANGULAR JS: <https://angularjs.org/>

Google Maps APIs: <https://developers.google.com/maps/?hl=de>

Umbrage cloud: <https://umbraco.com/>

Umbrage community: <https://our.umbraco.org/>

[updated 19.02.2018]

**Module offered in:**  
WS 2023/24

## Introduction to Communications Engineering

<b>Module name (EN): Introduction to Communications Engineering</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-NRTG
<b>Hours per semester week / Teaching method:</b> 4V+2P (6 hours per week)
<b>ECTS credits:</b> 7
<b>Semester:</b> 2
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b>  [still undocumented]
<b>Applicability / Curricular relevance:</b>  KIB-NRTG (P222-0022) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 2, mandatory course KIB-NRTG (P222-0022) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 2, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> <u>KIB-MAT1</u> Mathematics 1 <u>KIB-PTG</u> Physical and Technical Foundations  [updated 01.10.2022]

**Recommended as prerequisite for:****Module coordinator:**

Prof. Dr. Albrecht Kunz

**Lecturer:** Prof. Dr. Albrecht Kunz

[updated 01.10.2022]

**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**



<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-MAT1
<b>Hours per semester week / Teaching method:</b> 4V+2U (6 hours per week)
<b>ECTS credits:</b> 7
<b>Semester:</b> 1
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-MAT1 (P221-0001) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 1, mandatory course KIB-MAT1 (P221-0001) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 1, mandatory course PIB-MA1 (P221-0001) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 1, mandatory course PRI-MAT1 (P221-0001) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 1, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b> <u>KIB-INF2</u> Informatics 2 <u>KIB-NRTG</u> Introduction to Communications Engineering <u>KIB-SDSA</u> Simulation of Discrete Systems with AnyLogic  [updated 01.10.2022]
<b>Module coordinator:</b> <u>Prof. Dr. Peter Birkner</u>
<b>Lecturer:</b> <u>Prof. Dr. Peter Birkner</u>

[updated 01.10.2022]

**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  $(\mathbb{Z}/m\mathbb{Z}, +)$  and  $((\mathbb{Z}/p\mathbb{Z}) \setminus \{0\}, *)$ .

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  $\mathbb{Z}/m\mathbb{Z}$

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]

**Module offered in:**

WS 2023/24

## Mathematics 2

**Module name (EN): Mathematics 2**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , semester 2, mandatory course  
PRI-MAT2 (P221-0002) Production Informatics, Bachelor, ASPO 01.10.2023 , 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:**

KIB-RMA2  
KIB-SDSA Simulation of Discrete Systems with AnyLogic

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr. Peter Birkner

**Lecturer:** Prof. Dr. Peter Birkner

[updated 01.10.2022]

**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]

## Mathematics 3

**Module name (EN): Mathematics 3**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-MAT3

**Hours per semester week / Teaching method:**  
2V+1U (3 hours per week)

<p><b>ECTS credits:</b> 3</p>
<p><b>Semester:</b> 3</p>
<p><b>Mandatory course:</b> yes</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Written exam</p> <p>[updated 26.02.2018]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KIB-MAT3 (P222-0002) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 3, mandatory course  KIB-MAT3 (P222-0002) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 3, mandatory course  PRI-MAT3 (P222-0002) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 3, mandatory course</p>
<p><b>Workload:</b> 45 class hours (= 33.75 clock hours) over a 15-week period.  The total student study time is 90 hours (equivalent to 3 ECTS credits).  There are therefore 56.25 hours available for class preparation and follow-up work and exam preparation.</p>
<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> <u>Prof. Dr. Peter Birkner</u></p>
<p><b>Lecturer:</b> <u>Prof. Dr. Peter Birkner</u></p> <p>[updated 01.10.2022]</p>
<p><b>Learning outcomes:</b> After successfully completing this course, students will be able to apply the Fourier transform to technical problems such as the analysis of linear filters. They will be able to understand problems related to the functions of several independent variables and to design solutions.</p> <p>With the help of an introduction to probability calculus, they will be able to process and solve elementary combinatorial and probabilistic questions.</p> <p>[updated 26.02.2018]</p>
<p><b>Module content:</b> Complex numbers (advanced)</p>

Fourier series and Fourier transform  
Definitions, properties, examples  
Applications  
Functions with several independent variables  
n-dimensional space  
Multivariate function  
Differential calculus  
Probability calculus  
The concept of "probability"  
Conditional probability and independent events  
Urn experiments  
Random variables and distribution functions  
Expected value and variance  
Discrete distribution, Poisson distribution, normal (or Gaussian) distribution

[updated 26.02.2018]

**Recommended or required reading:**

[still undocumented]

**Module offered in:**

WS 2023/24

## Operating Systems

**Module name (EN):** Operating Systems

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-BS

**Hours per semester week / Teaching method:**

2V+2P (4 hours per week)

**ECTS credits:**

5

**Semester:** 3

**Mandatory course:** yes

**Language of instruction:**

German

**Assessment:**

Written exam 90 min.

[updated 19.02.2018]

**Applicability / Curricular relevance:**

DFIW-BS (P610-0191) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 4, mandatory course

KIB-BS (P222-0007) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 4, mandatory course

KIB-BS (P222-0007) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course

PIB-BS (P221-0013) Applied Informatics, Bachelor, ASPO 01.10.2017 , semester 4, mandatory course

PRI-BS (P222-0007) Production Informatics, Bachelor, ASPO 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):**

KIB-SYSE Systems Engineering

*[updated 01.10.2022]*

**Recommended as prerequisite for:****Module coordinator:**

Prof. Dr. Steffen Knapp

**Lecturer:** Prof. Dr. Steffen Knapp

*[updated 01.10.2022]*

**Learning outcomes:**

After successfully completing this module, students will be familiar with the typical structure and principles of operating systems and alternatives in development. In addition, they will also understand the maintenance strategies of the respective resources and the mechanisms of scheduling and process synchronization. They will be able to apply the contexts they have learned to other operating systems and environments.

*[updated 01.07.2021]*

**Module content:**

Introduction, Operating system concepts  
Memory management, paging  
Process management, competing processes  
Scheduling  
Synchronization  
Virtualization

*[updated 01.07.2021]*

**Teaching methods/Media:**

Combination of lecture and practical course/tutorial/exercises  
Lecture slides, exercises, sample solutions

*[updated 01.07.2021]*



**Recommended or required reading:**

J. Nehmer, P. Sturm: Systemsoftware-Grundlagen moderner Betriebssysteme, Punkt 2001  
 A. Tanenbaum, H. Bos: Moderne Betriebssysteme, Pearson Studium 2016  
 W. Stallings: Operating Systems, Prentice Hall, 2014  
 A. Silberschatz et al.: Operating System Concepts, Wiley, 2008

[updated 01.07.2021]

## Physical and Technical Foundations

<b>Module name (EN): Physical and Technical Foundations</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PTG
<b>Hours per semester week / Teaching method:</b> 3V+1S (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 1
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-PTG (P222-0023) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 1, mandatory course KIB-PTG (P222-0023) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 1, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b> <u>KIB-NRTG</u> Introduction to Communications Engineering

[updated 01.10.2022]

**Module coordinator:**  
Prof. Dr. Horst Wieker

**Lecturer:** Prof. Dr. Horst Wieker

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this module, students will be familiar with the physical and technical foundations of the electrical engineering processes adapted to information technology. Students will be familiar with the basic concepts of electrical circuits (Kirchhoff's circuit laws) and will be able to calculate voltages, currents and resistances in simple circuits. They will be able to use electrical symbols to solve tasks related to the static behavior and switch-on behavior of circuits with resistors, capacitors and inductors. In addition, they will also be familiar with the basics of semiconductor electronics. They will be able to calculate basic circuits with diode and transistor. In this module students will also acquire basic skills in the field of scientific work and self-organized learning.

[updated 26.02.2018]

**Module content:**

Basic terms and concepts (matter, charge, current, electric field strength, magnetic field strength, forces in the electrostatic and magnetic field, voltage, power)  
Passive dipoles (resistors, capacitors, inductors),  
Active dipoles (ideal voltage and power sources),  
Arrow systems, nodal and mesh rules  
Law of induction, magnetic resistance  
P-n junction  
Diode, transistor, basic circuits switch and amplifier

[updated 26.02.2018]

**Recommended or required reading:**

PAUL, Elektrotechnik für Informatiker, Teubner Verlag  
OSE, Elektrotechnik für Ingenieure, Hanser Verlag  
HAGMANN, Grundlagen der Elektrotechnik, AULA-Verlag  
ALTMANN/SCHLAYER, Lehr- und Übungsbuch Elektrotechnik, Hanser-Verlag

[updated 26.02.2018]

**Module offered in:**  
WS 2023/24

# Practical Course: Communication Systems

<b>Module name (EN): Practical Course: Communication Systems</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PKS
<b>Hours per semester week / Teaching method:</b> 4P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Oral  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-PKS (P222-0025) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, mandatory course KIB-PKS (P222-0025) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> <u>KIB-KT1</u> Communications Technology and Systems 1  [updated 01.10.2022]
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Horst Wieker</u>
<b>Lecturer:</b> <u>Prof. Dr. Horst Wieker</u>  [updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will be able to analyze and independently solve practical tasks in telecommunication-specific fields of work. The practical implementation and creation of technical documentation will be focused upon.

[updated 26.02.2018]

**Module content:**

The given content represents the basic tasks in the practical exercises. This involves solving and documenting both simple, individual tasks and complex, cross-content tasks.

1. Protocol analysis of TDM telecommunication systems
2. Planning and design of IP networks (logical structure, switching, routing)
3. Traffic engineering and performance monitoring by means of management systems
4. Protocol analysis of mobile radio systems
5. Structure of a VoIP system
6. IP security

[updated 26.02.2018]

**Recommended or required reading:**

SIEGMUND, Technik der Netze, Hüthig  
 BADACH/HOFFMANN, Technik der IP-Netze, Hanser  
 BADACH, Voice over IP - die Technik, Hanser  
 CHAPPELL, Wireshark 101, mitp (Hüthig)  
 Additional literature will be announced in the course with respect to the various assignments

[updated 26.02.2018]

**Module offered in:**

WS 2023/24

## Professional Presentations

**Module name (EN):** Professional Presentations

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-ENG3

**Hours per semester week / Teaching method:**

2SU (2 hours per week)

**ECTS credits:**

2

**Semester:** 3

**Mandatory course:** yes

**Language of instruction:**

English/German

**Assessment:**

Written exam

[updated 19.02.2018]

**Applicability / Curricular relevance:**

KIB-ENG3 (P222-0028) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 3, mandatory course

KIB-ENG3 (P222-0028) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course

PIB-EN3 (P221-0029) Applied Informatics, Bachelor, ASPO 01.10.2017 , semester 3, mandatory course

PRI-PPT (P223-0009) Production Informatics, Bachelor, ASPO 01.10.2023 , semester 3, 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):**

KIB-ENG1 Business Communication and Intercultural Competence

KIB-ENG2 Technical Reading and Writing

[updated 01.10.2022]

**Recommended as prerequisite for:****Module coordinator:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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 "Professional Presentations" module:

After successfully completing this module, students will understand strategies for the creation of professional, subject-specific presentations in English. They will be able to structure English-language presentations and use the verbal expressions they have mastered in them. In doing so, they will continue to develop their understanding of the functional use of language.

With regard to job application processes, students will be given the opportunity to prepare their application documents in English, apply and practice interview strategies and develop their intercultural awareness.

[updated 12.04.2018]

**Module content:**

Presentations

- Strategic knowledge
- Structure of a presentation in English
- Structures for linguistic implementation
- Describing tools, numbers, cause and effect correlations, and trends

Applying for a job

- Job advertisement
- Application documents
- Job interview

In addition, we will work on:

Vocabulary

Repeating relevant grammatical structures

Intercultural competence

Raising awareness for functional language use

[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 19.02.2018]

**Module offered in:**

WS 2023/24

## Programming 1

**Module name (EN): Programming 1**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-PRG1

<p><b>Hours per semester week / Teaching method:</b> 4V+2P (6 hours per week)</p>
<p><b>ECTS credits:</b> 8</p>
<p><b>Semester:</b> 1</p>
<p><b>Mandatory course:</b> yes</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b></p> <p>[<i>still undocumented</i>]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KIB-PRG1 (P222-0029) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 1, mandatory course  KIB-PRG1 (P222-0029) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 1, mandatory course  PRI-PRG1 (P222-0029) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 1, mandatory course</p>
<p><b>Workload:</b></p> <p>90 class hours (= 67.5 clock hours) over a 15-week period.  The total student study time is 240 hours (equivalent to 8 ECTS credits).  There are therefore 172.5 hours available for class preparation and follow-up work and exam preparation.</p>
<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b>  <u>KIB-PRG2</u> Programming 2  <u>KIB-PRG3</u> Programming 3  <u>KIB-SDSA</u> Simulation of Discrete Systems with AnyLogic  <u>KIB-SWT</u> Software Engineering</p> <p>[<i>updated 01.10.2022</i>]</p>
<p><b>Module coordinator:</b> Dr.-Ing. Eric Wagner</p>
<p><b>Lecturer:</b> Dr.-Ing. Eric Wagner</p> <p>[<i>updated 01.10.2022</i>]</p>
<p><b>Learning outcomes:</b>  After successfully completing this module, students will be able to explain the concepts of procedural programming and data abstraction and implement them in the C programming language. They will use</p>

design techniques to find solutions. They will use their knowledge about programming techniques, to create well-structured and documented programs. They will use basic tools from the field of software development to do so. In the practical course, students will learn to present programs and their solution concepts.

[updated 19.02.2018]

**Module content:**

1. Procedural programming/Data abstraction: Fundamental data types, operators, control structures, functions, pointers and arrays, validity ranges and lifetime of objects
2. Programming techniques: Modularization, separating interfaces and implementation, data structures and algorithms
3. Development tools: Preprocessor, compiler, linker, shell, shell scripts, makefile, debugger

[updated 19.02.2018]

**Teaching methods/Media:**

Combination of lecture and practical exercises in the computer lab, lecture slides and sample exercises in Moodle  
Internship assignments will be discussed, prepared and accepted in an audit, individual student coaching in the tutorials

[updated 19.02.2018]

**Recommended or required reading:**

C von A bis Z, Jürgen Wolf: [http://openbook.rheinwerk-verlag.de/c\\_von\\_a\\_bis\\_z/](http://openbook.rheinwerk-verlag.de/c_von_a_bis_z/)

Die Programmiersprache C. Ein Nachschlagewerk RRZN Hannover

C als erste Programmiersprache; Goll, Bröckl, Hausmann;Springer Viewer 2014

[updated 19.02.2018]

**Module offered in:**

WS 2023/24

## Programming 2

**Module name (EN):** Programming 2

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-PRG2

**Hours per semester week / Teaching method:**

4V+2P (6 hours per week)

**ECTS credits:**

8

**Semester:** 2



<p><b>Mandatory course:</b> yes</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Written exam</p> <p>[updated 19.02.2018]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KIB-PRG2 (P222-0030) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 2, mandatory course  KIB-PRG2 (P222-0030) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 2, mandatory course</p>
<p><b>Workload:</b>  90 class hours (= 67.5 clock hours) over a 15-week period.  The total student study time is 240 hours (equivalent to 8 ECTS credits).  There are therefore 172.5 hours available for class preparation and follow-up work and exam preparation.</p>
<p><b>Recommended prerequisites (modules):</b>  <u>KIB-PRG1</u> Programming 1</p> <p>[updated 01.10.2022]</p>
<p><b>Recommended as prerequisite for:</b>  <u>KIB-PRG3</u> Programming 3  <u>KIB-SDSA</u> Simulation of Discrete Systems with AnyLogic  <u>KIB-SWT</u> Software Engineering  <u>KIB-VS</u> Distributed Systems</p> <p>[updated 01.10.2022]</p>
<p><b>Module coordinator:</b>  <u>Prof. Dr.-Ing. Matthias Jung</u></p>
<p><b>Lecturer:</b> <u>Prof. Dr.-Ing. Matthias Jung</u></p> <p>[updated 01.10.2022]</p>
<p><b>Learning outcomes:</b>  After successfully completing this module, students will:</p> <ul style="list-style-type: none"> <li>_ be proficient in the basic language elements (data types, expressions, control structures, functions, exception handling) of C++.</li> <li>_ have grasped the concepts of object orientation (classes, objects, inheritance, polymorphism) and be able to implement them.</li> <li>_ have understood the concept of templates and be able to use them in programs.</li> <li>_ be able handle basic classes and algorithms of the C++ standard library (e. g. strings, input/output, container classes, generic algorithms) confidently.</li> <li>_ be able to develop solutions to simple to medium-difficult problems in small teams and implement them in</li> </ul>

a well-structured manner.

[updated 19.02.2018]

**Module content:**

1. Introduction and motivation
2. Elementary language elements in C++
3. Introduction to object-oriented programming
  - General overview
  - Introduction to classes and objects
  - Introduction to exception handling
4. Basic concepts
  - Scopes, type conversions
  - Functions and references
  - Using the documentation generator Doxygen
5. Classes and objects (Part 2)
  - Copy constructor, assignment operator
  - Class attributes and methods
6. Overloading operators
7. In-output and file processing
8. Inheritance
  - Basic concepts
  - Dynamic dispatch
  - Abstract classes
  - Multi inheritance
9. Exception handling (Part 2)
10. Templates
  - Function templates
  - Class templates
11. Standard template library
  - Concepts
  - Containers, algorithms, iterators

[updated 19.02.2018]

**Teaching methods/Media:**

Transparencies, projector

[updated 19.02.2018]

**Recommended or required reading:**

Breymann, Ulrich  
Der C++ Programmierer. C++ lernen - Professionell anwenden - Lösungen nutzen.  
Carl Hanser Verlag GmbH & CO. KG

Stroustrup, Bjarne  
Einführung in die Programmierung mit C++  
Pearson Studium

Grimm, Rainer  
C++11: Der Leitfaden für Programmierer zum neuen Standard  
Addison-Wesley, München;

Will, Torsten T.  
C++11 programmieren: 60 Techniken für guten C++11-Code

Galileo Computing

Eckel, Bruce

Thinking in C++

Prentice Hall, <http://www.BruceEckel.com>

Meyers, Scott

Effektiv C++ programmieren: 55 Möglichkeiten, Ihre Programme und Entwürfe zu verbessern

Addison-Wesley

Schäling, Boris

The Boost C++ Libraries

Xml Press

C++ Reference

<http://www.cppreference.com>

Bjarne Stroustrup's C++ Style and Technique FAQ

[www.stroustrup.com/C++11FAQ.html](http://www.stroustrup.com/C++11FAQ.html)

[updated 19.02.2018]

## Programming 3

<b>Module name (EN): Programming 3</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PRG3
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 4
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-PRG3 (P222-0031) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 4, mandatory course

KIB-PRG3 (P222-0031) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , 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):**

KIB-PM Project Management

KIB-PRG1 Programming 1

KIB-PRG2 Programming 2

KIB-SWT Software Engineering

[updated 01.10.2022]

**Recommended as prerequisite for:**

KIB-MADA Mobile Application Development (Android)

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr.-Ing. Matthias Jung

**Lecturer:** Prof. Dr.-Ing. Matthias Jung

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this module, students will:

- be able to develop executable software with the programming language Java.
- be able to analyze basic tasks and implement them object-oriented in Java.
- be able to map the concept of graphical-interactive user interfaces in JavaFX and implement an interactive GUI.
- be able to use distributed version control to work together as a development team.

[updated 19.02.2018]

**Module content:**

1. Basics
2. Program structure
3. Language elements
4. References
5. Packages
6. Inheritance and polymorphism
7. Interfaces
8. Exception handling
9. Version control
10. In/output
11. Threads
12. Graphical user interfaces
13. Collection API

[updated 19.02.2018]

**Teaching methods/Media:**

Lecture slides, examples, screencast video, exercises  
Lecture script available as a PDF download

[updated 19.02.2018]

**Recommended or required reading:**

J. Goll et al.: Java als erste Programmiersprache, Springer Link 2016  
D. Abts: Masterkurs Client/Server-Programmierung mit Java, Springer Link 2015  
C. Ullenboom: Java ist auch eine Insel, Rheinwerk 2011  
C. Ullenboom: Java - Mehr als eine Insel, Rheinwerk 2011  
E. Adams, J. Tormanns: Game Mechanics, Online od. Amazon  
W. Muehl, J. Novak: Game Simulation Development, Amazon

[updated 19.02.2018]

## Project Management

**Module name (EN): Project Management**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , semester 3, mandatory course

PRI-PM (P222-0032) Production Informatics, Bachelor, ASPO 01.10.2023 , semester 2, 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:**

KIB-PRG3 Programming 3

KIB-VS Distributed Systems

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr. Steffen Knapp

**Lecturer:** Prof. Dr. Steffen Knapp

[updated 01.10.2022]

**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]

## Protocols

<b>Module name (EN): Protocols</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PROT
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam (50%), case study (50%)  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>

KIB-PROT (P222-0034, P222-0035) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, mandatory course  
KIB-PROT (P222-0034, P222-0035) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , 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):**

KIB-KT1 Communications Technology and Systems 1  
KIB-RN Computer Networks

*[updated 01.10.2022]*

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Dr. Horst Wieker

**Lecturer:** Prof. Dr. Horst Wieker

*[updated 01.10.2022]*

**Learning outcomes:**

After successfully completing this module, students will be familiar with the basic structure of architectural models and their practical application. They will have in-depth knowledge of Ethernet and IP-based networks and can describe them.

After working on their composition, the students will be able to deal independently with new topics and prepare a formally correct composition.

*[updated 26.02.2018]*

**Module content:**

The basics of protocols and networks

Architecture models:

ISO/OSI model  
TCP/IP model

Ethernet

Structure and functionality of the layers

Evolution of standards

Modulation

Techniques: Autonegotiation, Auto-MDIX, PoE, EEE, \_

Frame formats

Channel access

IP

IPv4



Protocol, fragmentation, subnetting, routing, ICMP, ARP\_

#### IPv6

Protocol, addressing, NDP, transition mechanisms

Advanced network technologies

VLAN, STP

Composition

Topics will be based on the focal points of the lecture.

[updated 26.02.2018]

#### **Recommended or required reading:**

Badach; Hoffmann: Technik der IP Netze, Hanser Verlag, 2001

Hagen, Silvia: IPv6 Essentials, O\_Reilly Verlag, 2014

Hein, Mathias: Ethernet, mitp Verlag, 2002

Hucaby, David, CCNP BCMSN, Cisco Press Verlag, 2007

Kauffels, Franz-Joachim: Wireles LANs, mitp Verlag, 2002

König, Hartmut: Protocol Engineering, Teubner Verlag, 2003

Lienemann, Gerhard, TCP/IP Grundlagen, Heinz Heise Verlag, 2003

Rech, Jörg: Ethernet - Technologien und Protokolle für die Computervernetzung, D-Punkt Verlag, 2007

Odem, W., CCENT/CCNA ICND1, Cisco Press, 2008

Odem, W., CCNA ICND2, Cisco Press, 2008

Sigmund, Gerd: Technik der Netze, Hüthig Verlag, 2002

[updated 26.02.2018]

#### **Module offered in:**

WS 2023/24

## Security Engineering

**Module name (EN): Security Engineering**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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

[updated 26.02.2018]

**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 01.10.2017 , semester 4, mandatory course

PRI-SE (P222-0039) Production Informatics, Bachelor, ASPO 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. Damian Weber

**Lecturer:** Prof. Dr. Damian Weber

[updated 01.10.2022]

**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]

# Software Engineering

**Module name (EN): Software Engineering**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-SWT

**Hours per semester week / Teaching method:**

4V (4 hours per week)

**ECTS credits:**

5

**Semester:** 3

**Mandatory course:** yes

**Language of instruction:**

German

**Assessment:**

Oral examination

[updated 19.02.2018]

**Applicability / Curricular relevance:**

KIB-SWT (P221-0004) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 3, mandatory course

KIB-SWT (P221-0004) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 3, mandatory course

PIB-SWT (P221-0004) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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):**

KIB-PRG1 Programming 1

KIB-PRG2 Programming 2

[updated 01.10.2022]

**Recommended as prerequisite for:**

KIB-PRG3 Programming 3

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr.-Ing. Martin Burger

**Lecturer:** Prof. Dr.-Ing. Martin Burger

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this module, students will:

\_ be familiar with the most important current process models in software development and will be able to explain their particularities and differences.

\_ be familiar with the problems in requirements analysis and, as a team, be able to create requirement specifications when given simple to medium fuzzy problem descriptions.

\_ be proficient in the basic concepts of object-oriented analysis and can analyze and structure simple to medium-sized software development problems and model solutions using UML diagrams.

\_ be familiar with some of the most important architectural and design patterns in software development and be able to explain them in detail.

\_ be able to analyze tasks in teamwork and create solutions with the skills and tools learned.

[updated 26.02.2018]

**Module content:**

Students will be given an overview of sub-areas in software technology. They will get to know both classical and object-oriented process models in software development. The lecture will focus on object-oriented analysis and design. The most important diagrams from the Unified Modeling Language (UML) will be applied and practiced with the help of practice-oriented examples, exercises and an OOA/D tool.

1. Introduction to and overview of software engineering

2. Process models

2.1. Waterfall model

2.2. V-Modell 97 and XT

2.3. Iterative incremental software development

2.3. Spiral model

2.4. Rational Unified Process

2.5. Agile process models

3. Details of process models

3.1 Feasibility study/functional specifications

3.2 Requirement analysis/technical specifications

3.3 Cost estimation

- 4. Static concepts of object-oriented analysis
  - 4.1. Basic OO concepts
  - 4.2. Static concepts
  - 4.3. Class diagrams
  
- 5. Dynamic concepts of object-oriented analysis
  - 5.1. Use cases and use case diagrams
  - 5.2. Activity diagrams
  - 5.3. Scenarios and sequence diagrams
  - 5.4. State machines
  - 5.5. Procedure for an analysis process
  - 5.6. Analysis patterns
  
- 6. Design phase
  - 6.1. Introduction to object-oriented design
  - 6.2. Introduction and overview
  - 6.3. Essential GoF patterns
  
- 7. Introduction to Software Quality Management
  - 7.1. Introduction and overview
  - 7.2. Software tests

[updated 19.02.2018]

**Teaching methods/Media:**

Transparencies, projector, lecture-specific homepage

[updated 19.02.2018]

**Recommended or required reading:**

Ludewig, Jochen; Lichter, Horst: Software Engineering. Grundlagen, Menschen, Prozesse, Techniken; dpunkt.verlag

Balzert, Heide: Lehrbuch der Objektmodellierung: Analyse und Entwurf mit der UML 2, Spektrum Akademischer Verlag

Balzert, Helmut, Lehrbuch der Softwaretechnik, Spektrum Akademischer Verlag Band 1 Software-Entwicklung

Oestereich Bernd, Objektorientierte Softwareentwicklung: Analyse und Design mit der UML 2.1, Oldenbourg

Ian Sommerville: Software Engineering; Pearson; München

Gamma, Erich / Helm, Richard / Johnson, Ralph / Vlissides, John: Entwurfsmuster \_ Elemente wiederverwendbarer objektorientierter Software; Addison-Wesley; München / Boston

Rupp, Queins, Zengler: UML 2 Glasklar, Hanser

Martin Fowler: UML konzentriert; Addison-Wesley; München/Boston

[updated 19.02.2018]

**Module offered in:**

WS 2023/24

# Technical Reading and Writing

<b>Module name (EN):</b> Technical Reading and Writing
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ENG2
<b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 2
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> English/German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-ENG2 (P222-0043) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 2, mandatory course KIB-ENG2 (P222-0043) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 2, mandatory course PIB-EN2 (P221-0196) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 2, mandatory course PRI-TRW (P222-0043) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 2, mandatory course  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> <u>KIB-ENG1</u> Business Communication and Intercultural Competence  [updated 01.10.2022]
<b>Recommended as prerequisite for:</b> <u>KIB-ENG3</u> Professional Presentations

[updated 01.10.2022]

**Module coordinator:**  
Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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

<b>Module name (EN): Theoretical Informatics</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-TI
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 4
<b>Mandatory course:</b> yes
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-TI (P222-0044) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 3, mandatory course KIB-TI (P222-0044) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 4, mandatory course PIB-TI (P221-0041) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 3, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Maximilian Altmeyer</u>
<b>Lecturer:</b> <u>Prof. Dr. Maximilian Altmeyer</u>



[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Work Experience Phase

**Module name (EN):** Work Experience Phase

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-PRA

**Hours per semester week / Teaching method:**

-

**ECTS credits:**

15

**Semester:** 6

**Mandatory course:** yes

**Language of instruction:**

German

**Assessment:**

Study report, presentation

[updated 26.02.2018]

**Applicability / Curricular relevance:**

DFIW-PRA (S610-0210) Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019 , semester 6, mandatory course

KIB-PRA (S222-0026) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, mandatory course

KIB-PRA (S222-0026) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, mandatory course

PIB-PRA (S221-0173) Applied Informatics, Bachelor, ASPO 01.10.2017 , semester 6, mandatory course

PRI-PRA (S223-0002) Production Informatics, Bachelor, ASPO 01.10.2023 , semester 6, mandatory course

**Workload:**

The total student study time for this course is 450 hours.

**Recommended prerequisites (modules):**

None.

**Recommended as prerequisite for:**

**Module coordinator:**

Studienleitung

**Lecturer:** Studienleitung

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this module, students will:

- \_ be able to apply the skills and knowledge acquired during their studies to project tasks in a company.
- \_ have learned to familiarize themselves with a new working environment.
- \_ have solved concrete, thematically focused problems in a company.
- \_ have gained actual practical insight into the role of computer scientists in a company.
- \_ be familiar with the organizational structure of a company.

[updated 26.02.2018]

**Module content:**

Together, the student, their university supervisor and the company where the internship is carried out will

determine the topics to be worked on by the student during his or her internship. The work done during the internship should prepare students for the bachelor thesis to be written afterwards

Each student will write a report of approx. 8-10 DIN A4 pages about the work done during their internship and describe their practical experience.

In addition, they are required to give a short lecture on the contents of his practical phase.

[updated 26.02.2018]

**Recommended or required reading:**

Depends on the respective subject areas dealt with in practice.

[updated 26.02.2018]

## Computer Science and Communication Systems Bachelor - optional courses

### .NET Concepts and Tools

<b>Module name (EN):</b> .NET Concepts and Tools
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-NETW
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KI665 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-NETW (P221-0096) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical

KIB-NETW (P221-0096) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical  
PIBW179 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific  
PIB-NETW (P221-0096) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN): "Engineering Visions" Intensive Program</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-IPRE
<b>Hours per semester week / Teaching method:</b> 3PA+1S (4 hours per week)
<b>ECTS credits:</b> 4
<b>Semester:</b> 4
<b>Mandatory course:</b> no
<b>Language of instruction:</b> English
<b>Assessment:</b> Written composition with presentation  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  BMT553 (P200-0014) <u>Biomedical Engineering, Bachelor, ASPO 01.10.2011</u> , optional course, non-technical KI606 (P200-0014) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 4, optional course, non-technical KIB-IPRE (P222-0118) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 4, optional course, non-technical KIB-IPRE (P222-0118) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 4, optional course, non-technical MAB.4.2.1.29 (P222-0118) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 3, optional course, general subject MST.IPE (P222-0118) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 4, optional course, non-technical MST.IPE (P222-0118) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , 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 01.10.2017 , 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 01.10.2022]

**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, the 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

<b>Module name (EN): Applied Computer Science Seminar</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-SAI
<b>Hours per semester week / Teaching method:</b> 2S (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Presentation/discussion (obligation to attend all presentations), term paper  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI594 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-SAI (P221-0092) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-SAI (P221-0092) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBW147 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-SAI (P221-0092) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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.

<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> <u>Prof. Dr.-Ing. André Miede</u></p>
<p><b>Lecturer:</b> <u>Prof. Dr.-Ing. André Miede</u>  [updated 01.10.2022]</p>
<p><b>Learning outcomes:</b> 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]</p>
<p><b>Module content:</b> 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.</p> <ol style="list-style-type: none"> <li>1. Methodological basics <ul style="list-style-type: none"> <li>o Scientific work</li> <li>o Structuring arguments</li> <li>o Seminar lectures and presentations</li> </ul> </li> <li>2. Technical basics <ul style="list-style-type: none"> <li>o Introduction to LaTeX</li> <li>o Reference management</li> <li>o Using templates (IEEE)</li> </ul> </li> <li>3. Seminar <ul style="list-style-type: none"> <li>o Processing current topics according to the chosen topic</li> <li>o Presentation of the results to the group</li> <li>o Group discussion and exchange</li> <li>o Written composition (term paper)</li> <li>o Group discussion and exchange</li> <li>o Written composition (term paper)</li> </ul> </li> </ol> <p>[updated 19.02.2018]</p>
<p><b>Teaching methods/Media:</b> Transparencies/beamer, board, coaching, homework, group discussions, student presentations, written exercises  [updated 19.02.2018]</p>



**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]

**Module offered in:**

WS 2023/24

## Automotive Engineering

<b>Module name (EN): Automotive Engineering</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ATEC
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b>  [still undocumented]
<b>Applicability / Curricular relevance:</b>  E1614 (P200-0003) <u>Electrical Engineering, Bachelor, ASPO 01.10.2012</u> , semester 6, mandatory course E2433 <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, technical KI620 (P200-0003) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-ATEC (P222-0111) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical

KIB-ATEC (P222-0111) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical  
PIBW133 (P200-0003) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific  
PIB-ATEC (P200-0003) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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 Transport 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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 (P200-0013, P211-0242) Electrical Engineering, Bachelor, ASPO 01.10.2012 , optional course  
EE-K2-546 (P200-0013) Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015 ,  
optional course, engineering  
E2582 (P200-0013) Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018 ,

optional course, general subject

FT63 (P200-0013) Automotive Engineering, Bachelor, ASPO 01.04.2016 , semester 5, optional course, technical

FT63 (P200-0013) 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 (P200-0013) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 6, optional course, non-technical

KIB-AUSB (P200-0013) 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 (P200-0013) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012 , optional course, non-technical

MST.GAU (P200-0013) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019 , optional course, non-technical

MST.GAU (P200-0013) Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020 , optional course, non-technical

PIBWN66 (P200-0013) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific

PIB-AUSB (P200-0013) Applied Informatics, Bachelor, ASPO 01.10.2017 , semester 4, optional course, not informatics specific

MST.GAU (P200-0013) 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 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Brain-Computer Interface

**Module name (EN):** Brain-Computer Interface

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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

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 Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]*

**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](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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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 Wiek

**Lecturer:** Prof. Dr. Horst Wiek

*[updated 01.10.2022]*

**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 FTTH 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://en.wikipedia.org/wiki/Fiber_to_the_x)

<http://de.wikipedia.org/wiki/Glasfasernetz>

[http://de.wikipedia.org/wiki/Gigabit\\_Passive\\_Optical\\_Network](http://de.wikipedia.org/wiki/Gigabit_Passive_Optical_Network)



[http://en.wikipedia.org/wiki/Very-high-bit-rate\\_digital\\_subscriber\\_line\\_2](http://en.wikipedia.org/wiki/Very-high-bit-rate_digital_subscriber_line_2)

[updated 26.02.2018]

## CAX Basics and Applications

<b>Module name (EN): CAX Basics and Applications</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-CAX
<b>Hours per semester week / Teaching method:</b> 2V+2U (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 3
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b>  [updated 16.11.2023]
<b>Applicability / Curricular relevance:</b>  KIB-CAX (P223-0006) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 3, optional course, technical KIB-CAX (P223-0006) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 3, optional course, technical MAB_19_4.2.1.38 (P223-0006) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019</u> , semester 3, optional course, technical MST2.CAX (P223-0006) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 3, optional course PIB-CAX (P223-0006) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 3, optional course, not informatics specific PRI-CAX (P223-0006) <u>Production Informatics, Bachelor, ASPO 01.10.2023</u> , semester 3, mandatory course
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b>

None.

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Dr.-Ing. Pascal Stoffels

**Lecturer:** Prof. Dr.-Ing. Pascal Stoffels

*[updated 15.09.2023]*

**Learning outcomes:**

- After successfully completing this module, students will: be able to model components using a CAD system - e.g. Siemens NX - with its basic functions and commands.
- Students will be aware of the production-oriented adherence to guidelines regarding the standardization of components.
  - They will be familiar with the influences of manufacturing processes on the design of components - for example, for machining (turning/milling), forming (bending) or additive manufacturing (3D printing)
  - They will be able to transfer their knowledge to other production processes and independently familiarize themselves with technology-specific characteristics.

*[updated 16.11.2023]*

**Module content:**

- Fundamentals of 3D-CAD technology; representations in 2D and 3D form (DIN 5/6); line types, penetration, drawing scales, title block, dimension entry in drawings, introduction to 3D-CAD software for designing components, introduction to selected machine elements, assembly exercise for the haptic experience of machine elements and assembly processes, surface marks, tolerance specifications, fit specifications, general tolerances, form and position tolerance, calculation of tolerance chains and definition of surface qualities
- Overview of the current state of the art and future developments.
- Basic applications and functions: Structural components, assemblies, drawing views, exploded-view drawings
- Standardized names of structural components, elements and detail surfaces (groove, chamfer, pocket, shaft, undercut, etc.).
- Consideration of the individual production steps suitable for manufacturing the components with their detailed surfaces
- Rough planning of the sequences in terms of a production process
- Manufacturing tolerances and their consideration in component design
- Procedures for designing components

*[updated 16.11.2023]*

**Teaching methods/Media:**

- Lecture using multimedia-supported training courses and integrated exercises.

*[updated 16.11.2023]*

**Recommended or required reading:**

- Hoenow, G.; Meißner, T.: Entwerfen und Gestalten im Maschinenbau. Fachbuchverlag Leipzig. - Hoenow, G.; Meißner, T.: Konstruktionspraxis im Maschinenbau. Hanser-Verlag.
- Hintzen, Laufenberg, Kurz: Konstruieren, Gestalten, Entwerfen. Vieweg-Verlag.
- Inventor 2020 Grundlagen, Herdt Verlag, ISBN: 978-3-86249-856-7
- Basiskurs für Autodesk Inventor 2020; Armin Gräf Verlag, [www.armin-graef.de/shop](http://www.armin-graef.de/shop)
- Grundlagenkurs Inventor 2019, Carl Hanser Verlag GmbH & Co. KG zum Download aus der HTW Bücherei!
- Grundlagenkurs Inventor 2019, Carl Hanser Verlag GmbH & Co. KG zum Download aus der HTW Bücherei!
- Gebhardt A.; Additive Fertigungsverfahren Additive Manufacturing und 3D-Drucken für Prototyping Tooling Produktion; Hanser Verlag; 2016
- Breuninger J., Becker R., Wolf A., Rommel S.; Generative Fertigung mit Kunststoffen, Springer Verlag; 2013
- Gibson I., Rosen D., Stucker B.; Additive Manufacturing Technologies 3D-Printing, Rapid Prototyping, and Direct Digital Manufacturing

[updated 16.11.2023]

**Module offered in:**  
WS 2023/24

## Cloud Computing

<b>Module name (EN):</b> Cloud Computing
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-CCOM
<b>Hours per semester week / Teaching method:</b> 2V+2PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b>  [still undocumented]
<b>Applicability / Curricular relevance:</b>  KI699 (P221-0066) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , 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  
PIBW118 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific  
PIB-CCOM (P221-0066, P221-0181) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN):</b> Compiler Construction
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-CBAU
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> 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

PIBW155 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific

PIB-CBAU Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]*

**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 04.09.2023]*

**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]

**Module offered in:**

WS 2023/24

## Computer Science and Society Seminar

**Module name (EN):** Computer Science and Society Seminar

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN): Computer Science in the Media</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-SIDM
<b>Hours per semester week / Teaching method:</b> 2S (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German/English
<b>Assessment:</b> Seminar presentation, discussion (obligation to attend all presentations), term paper
[updated 26.02.2018]
<b>Applicability / Curricular relevance:</b> KI697 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-SIDM <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-SIDM <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBW127 (P221-0129) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , optional course, informatics specific

PIB-SIDM (P221-0129) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]*

**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:**

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

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

*[updated 26.02.2018]*

# Computer Vision

<b>Module name (EN): Computer Vision</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-CVIS
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI692 (P221-0069) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-CVIS (P221-0069) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-CVIS (P221-0069) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical MST.CVI (P221-0069) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 6, optional course, technical MST.CVI (P221-0069) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , semester 6, optional course, technical MST.CVI (P221-0069) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 6, optional course, technical PIBW183 (P221-0069) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-CVIS (P221-0069) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, informatics specific MST.CVI (P221-0069) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, technical
<b>Workload:</b> 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 01.10.2022]

**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 Processing, 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

<b>Module name (EN): Design Patterns</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-EWM
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Oral examination  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI681 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-EWM (P221-0075) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-EWM (P221-0075) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBWI73 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-EWM (P221-0075) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>

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

**Lecturer:** Prof. Dr.-Ing. Martin Burger

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Digital Signal Processing

**Module name (EN): Digital Signal Processing**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Digital Television Technology

**Module name (EN): Digital Television Technology**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN): Electromobility</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-EMOB
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b>  [still undocumented]
<b>Applicability / Curricular relevance:</b>  E2533 (P211-0211) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, technical FT62 (P211-0211) <u>Automotive Engineering, Bachelor, ASPO 01.04.2016</u> , semester 6, optional course, specialisation FT62 (P211-0211) <u>Automotive Engineering, Bachelor, ASPO 01.10.2019</u> , semester 6, optional course, specialisation, course inactive since 18.01.2024 KI617 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-EMOB (P211-0211) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> ,

semester 6, optional course, technical  
KIB-EMOB (P211-0211) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 ,  
semester 6, optional course, technical  
PIBW159 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics  
specific  
PIB-EMOB (P211-0211) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN):</b> Embedded Linux
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-EMBL
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 4
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> 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  
PIBW131 (P221-0074) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, technical  
PIB-EMBL Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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 "Von A bis Z", Galileo Computing  
Hans Werner Lang "Algorithmen", Oldenbourg  
Jörg Wiegmann "Softwareentwicklung in C für Mikroprozessoren und Mikrocontroller", Hüthig Verlag  
Using the FreeRTOS Real time kernel (e-book at [www.freertos.org](http://www.freertos.org) [[www.freertos.org](http://www.freertos.org)])  
FreeRTOS Reference Manual (e-book at [www.freertos.org](http://www.freertos.org) [[www.freertos.org](http://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

<b>Module name (EN): Enterprise Java Beans</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-EJB
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KI619 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-EJB (P221-0105) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical

KIB-EJB (P221-0105) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 6, optional course, technical  
PIBW149 (P221-0105) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific  
PIB-EJB (P221-0105) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN): Error-Identification and Error-Correcting Codes</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-FFKC
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam 90 min.  [updated 05.10.2020]
<b>Applicability / Curricular relevance:</b>  DFBI-346 (P610-0203) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018</u> , semester 6, optional course, informatics specific KI656 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-FFKC (P222-0115) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-FFKC (P222-0115) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical MST.FKC (P231-0131) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , 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

PIBW156 (P221-0109) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific

PIB-FFKC (P221-0109) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## French for Beginners II

**Module name (EN): French for Beginners II**

<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-FFA2
<b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written examination (final exam)  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  E2423 (P200-0012, P420-0461) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, non-technical KI660 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, non-technical KIB-FFA2 (P200-0012) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, non-technical KIB-FFA2 (P200-0012) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, non-technical MAB.4.2.1.7 (P200-0012) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 6, optional course MST.FA2 (P200-0012) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 6, optional course, non-technical MST.FA2 (P200-0012) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , semester 6, optional course, non-technical MST.FA2 (P200-0012) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 6, optional course, non-technical PIBWN41 (P200-0012) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, not informatics specific PIB-FFA2 (P200-0012) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 6, optional course, not informatics specific MST.FA2 (P200-0012) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, non-technical
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b>

None.

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

*[updated 01.10.2022]*

**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

<b>Module name (EN): French I</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-FRA1
<b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written examination (final exam)  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  E2520 (P200-0026) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, non-technical E2842 (P211-0298) <u>Electrical Engineering and Information Technology, Master, ASPO 01.04.2019</u> , optional course, general subject, course inactive since 30.03.2021 KI657 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, non-technical KIB-FRA1 (P200-0026) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , 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 01.10.2017 , 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:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## French II

<b>Module name (EN): French II</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-FRA2
<b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written examination (final exam)  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  EE-K2-523 (P241-0295) <u>Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012</u> , semester 6, optional course EE-K2-523 (P241-0295) <u>Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015</u> , semester 6, optional course, course inactive since 14.03.2018 E2521 (P241-0295) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, general subject KI658 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, non-technical KIB-FRA2 (P241-0295) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, non-technical KIB-FRA2 (P241-0295) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, non-technical MAB.4.2.1.17 (P200-0027) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 6, optional course MST.FR2 (P200-0027) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 6, optional course MST.FR2 (P200-0027) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , semester 6, optional course MST.FR2 (P200-0027) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 6, optional course PIBWN36 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, not informatics specific PIB-FRA2 (P241-0295) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 6, optional course, not informatics specific MST.FR2 (P200-0027) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011</u> , 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:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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**

<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-FPRG
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b>  [ <i>still undocumented</i> ]
<b>Applicability / Curricular relevance:</b>  KI571 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-FPRG <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-FPRG <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBWI14 (P221-0112) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-FPRG (P221-0112) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Thomas Kretschmer</u>
<b>Lecturer:</b> <u>Prof. Dr. Thomas Kretschmer</u>  [ <i>updated 01.10.2022</i> ]

**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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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):**

KIB-RN Computer Networks

[updated 01.10.2022]

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Joberto Martins

**Lecturer:** Prof. Joberto Martins

[updated 01.10.2022]

**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 Infrastructure 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]

**Module offered in:**  
WS 2023/24

## **Future Internet: Software Defined Networking**

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

<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-FSDN
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 4
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam/paper  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KI596 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-FSDN <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-FSDN <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBWI44 (P221-0076) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-FSDN <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Damian Weber</u>
<b>Lecturer:</b> <u>Prof. Dr. Damian Weber</u>  [updated 01.10.2022]

**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 and Development

**Module name (EN):** Game Design and Development

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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

PIBW143 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific

PIB-GDEV (P221-0077) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## GUI Programming with Qt

<b>Module name (EN): GUI Programming with Qt</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PRQT
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> according to optional course list
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KI603 (P221-0079) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , optional course, informatics specific KIB-PRQT (P222-0116) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , optional course, technical KIB-PRQT (P222-0116) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , optional course, technical PIBW163 (P221-0079) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , optional course, informatics specific PIB-PRQT (P221-0079) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , 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 01.10.2022]

**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**

<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-HCI
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KI636 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-HCI (P221-0062) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-HCI (P221-0062) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical KI855 <u>Computer Science and Communication Systems, Master, ASPO 01.04.2016</u> , semester 2, optional course, course inactive since 30.09.2009 MAM.2.1.2.20 (P221-0062) <u>Engineering and Management, Master, ASPO 01.10.2013</u> , semester 1, optional course, specialisation PIBW190 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-HCI (P221-0062) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> Prof. Steven Frysinger



**Lecturer:** Prof. Steven Frysinger

[updated 01.10.2022]

**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 26.02.2018]

**Recommended or required reading:**

Interaction Design (second edition). Jennifer Preece, Yvonne Rogers, Helen Sharp, John Wiley and Sons, 2007.

[updated 26.02.2018]

**Module offered in:**

WS 2023/24

## Industrial Development Processes

**Module name (EN): Industrial Development Processes**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Industrial Ecology

**Module name (EN): Industrial Ecology**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 (P241-0162) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific

PIB-INEC (P241-0162) Applied Informatics, Bachelor, ASPO 01.10.2017 , semester 4, optional course, not informatics specific

Suitable for exchange students (learning agreement)

<p><b>Workload:</b>  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.</p>
<p><b>Recommended prerequisites (modules):</b>  None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b>  Prof. Steven Frysinger</p>
<p><b>Lecturer:</b> Prof. Steven Frysinger   [updated 01.10.2022]</p>
<p><b>Learning outcomes:</b>  After successfully completing this module, students will be able to:</p> <ul style="list-style-type: none"> <li>- Define environmental science and describe the key environmental challenges presented by industrial society;</li> <li>- Define industrial ecology and explain the metaphorical relationship between industrial systems and biological ecosystems;</li> <li>- Interpret the <i>_master equation_</i> of industrial ecology and explain the role of technology in the pursuit of a more sustainable industrial society;</li> <li>- Define and give examples of the concepts of Design for Environment and Environmentally Conscious Manufacturing;</li> <li>- Provide a detailed explanation of the Life Cycle Assessment methodology and carry out such an assessment on a product/system;</li> <li>- Discuss allocation of environmental loads to system components;</li> <li>- Interpret the role of Life Cycle Assessment in environmental management decision-making.</li> </ul> <p>[updated 26.02.2018]</p>
<p><b>Module content:</b>  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.</p> <p>[updated 26.02.2018]</p>
<p><b>Recommended or required reading:</b>  GRAEDEL, T. E./ B. R. ALLENBY, B.R.: Industrial Ecology. Prentice Hall, 2003.</p> <p>[updated 26.02.2018]</p>

## Information Retrieval

<p><b>Module name (EN): Information Retrieval</b></p>
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<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-IRET
<b>Hours per semester week / Teaching method:</b> 2V+2PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> English
<b>Assessment:</b> Written exam/Project  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  DFIW-IRET (P610-0540) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019</u> , semester 3, mandatory course, informatics specific KI584 (P221-0080, P610-0253) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, informatics specific KIB-IRET <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-IRET <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBWI29 (P221-0080) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-IRET (P221-0080) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Klaus Berberich</u>

**Lecturer:** Prof. Dr. Klaus Berberich

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will have learned basic information retrieval methods.

This

includes retrieval models (e.g., Vector Space 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 26.02.2018]

**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
- Apache Lucene/Solr
- ElasticSearch

[updated 26.02.2018]

### **Recommended or required reading:**

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/>)

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>)

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

[updated 26.02.2018]

## Information Security

<b>Module name (EN): Information Security</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ISEC
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> 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

PIBW199 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific

PIB-ISEC (P221-0063) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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-Grundschatz Kataloge) and how they are applied.

To do so, they will be familiar with the procedure according to IT-Grundschatz (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]

**Module offered in:**

WS 2023/24

## **Intercultural Communication**

**Module name (EN): Intercultural Communication**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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

<b>Module name (EN):</b> Internet and the Law
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-REII
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 5
<b>Mandatory course:</b> no

<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Written exam</p> <p>[updated 26.02.2018]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KI651 (P221-0061) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, non-technical  KIB-REII (P221-0061) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, non-technical  KIB-REII (P221-0061) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, non-technical  MAB.4.2.7.4 <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 5, optional course, non-technical  PIBWN60 (P221-0061) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, not informatics specific  PIB-REII (P221-0061) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, not informatics specific</p>
<p><b>Workload:</b>  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.</p>
<p><b>Recommended prerequisites (modules):</b>  None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b>  <u>RA Cordula Hildebrandt</u></p>
<p><b>Lecturer:</b> <u>RA Cordula Hildebrandt</u></p> <p>[updated 01.10.2022]</p>
<p><b>Learning outcomes:</b>  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.</p> <p>[updated 26.02.2018]</p>

**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 -&gt; Skripten -&gt; A. Zivilrecht

<http://www.uni-muenster.de/Jura.itm/ hoeren/>

Navigation bar: Lehre -&gt; Materialien -&gt; Skriptum Internet-Recht

[updated 26.02.2018]

**Module offered in:**

WS 2023/24

## Internet Development with Java 1

**Module name (EN):** Internet Development with Java 1

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-IJA1

**Hours per semester week / Teaching method:**

2V+2P (4 hours per week)

**ECTS credits:**

5

<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI581 (P221-0081) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-IJA1 (P221-0081) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-IJA1 (P221-0081) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBW124 (P221-0081) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , optional course, informatics specific PIB-IJA1 (P221-0081) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Dipl.-Inf. Christopher Olbertz</u>
<b>Lecturer:</b> <u>Dipl.-Inf. Christopher Olbertz</u>  [updated 01.10.2022]
<b>Learning outcomes:</b> After successfully completing this course, students will: - be able to manage, modularize and document a project with Maven. - understand the Java configuration of Spring. - be able to use SpringBoot for their own web applications. - be able to write a Java application with JSPs. - understand the life cycle of JSF and can apply it to their own programs. - be capable of developing and running a JSF-based application.  [updated 19.02.2018]

**Module content:**

The lecture offers an introduction to modern Java technologies for the development of dynamic websites. Stand-alone programs are developed on a SpringBoot basis with an integrated web server. However, all technologies also work on a common server such as GlassFish. The main focus of the lecture is on JavaServer Faces.

1. Basic terms from the field of web development
2. Maven
  - 2.1. Principles of Maven
  - 2.2. Modularization with Maven
  - 2.3. Profiles
  - 2.4. Documentation with Maven
3. Spring and SpringBoot
  - 3.1. Introduction to Spring and SpringBoot
  - 3.2. Java configuration of Spring
  - 3.3. Advanced Springboot configuration
4. JavaServer Pages (JSP)
  - 4.1. Short introduction to servlets
  - 4.2. JSP
5. JavaServer Faces
  - 5.1. The concept of JavaServer Faces and the lifecycle of JSF pages
  - 5.2. Portlets with JavaServer Faces
  - 5.3. ManagedBeans as an interface between Java and websites
  - 5.4. Event handling in JSF
  - 5.5. Validation with JSF
  - 5.6. JSF Ajax library
  - 5.7. Introduction to PrimeFaces
  - 5.8. The JSF template mechanism
  - 5.9. Developing your own components
  - 5.10. Running JSF applications with SpringBoot
  - 5.11. Running JSF applications with a GlassFish server

[updated 19.02.2018]

**Teaching methods/Media:**

Transparencies with notes, exercises, Kahoot quiz

[updated 19.02.2018]

**Recommended or required reading:**

Martin Spiller: Maven 3 - Konfigurationsmanagement mit Java

Andy Bosch: Portlets und JavaServer Faces

Burns Schalk: JavaServer Faces 2.0

Bernd Müller: JavaServer Faces 2.0

[updated 19.02.2018]

## Internet Development with Java 2

**Module name (EN): Internet Development with Java 2**



<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-IJA2
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project, presentation, documentation  [updated 24.02.2018]
<b>Applicability / Curricular relevance:</b>  KI577 (P221-0082) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-IJA2 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-IJA2 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBW121 (P221-0082) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-IJA2 <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 6, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Dipl.-Inf. Christopher Olbertz</u>
<b>Lecturer:</b> <u>Dipl.-Inf. Christopher Olbertz</u>  [updated 01.10.2022]

**Learning outcomes:**

After successfully completing this course, students will:

- be able to set up, configure and operate a Liferay portal server.
- be able to develop their own portlets that correspond to the standard.
- be able to develop their own portlets with the Liferay API.
- be able to use Apache Tiles as a templating mechanism.
- be able to use other Spring projects in their web application.
- be able to develop their own applications in Vaadin.

[updated 24.02.2018]

**Module content:**

This lecture is based on "Internet Development with Java 1" and teaches further concepts in web page development with the programming language Java. One of the topics is for example, the construction and operation of a Java portal based on the OpenSource container Liferay using the SystemTechnikPortal that runs in the SystemTechnikLab. First, the concepts of the portlet standard (JSR 286) and the development of portlets with the standard will be discussed. Then, we will learn about Liferay's proprietary API that makes development much easier. In addition, Vaadin will be introduced as an alternative View technology to JSP/JSF.

**1. Portlet concepts and basics**

- 1.1. Introduction: basics and concepts of portlet technology
- 1.2. Liferay as a portlet container
- 1.3. Portlet 2.0 (JSR 286)
- 1.4. JavaServer Pages (JSP) as a standard presentation technology
- 1.5. Basic administration of a portal server

**2. Liferay API**

- 2.1. Developing with the Plugins SDK
- 2.2. Service Builder
- 2.3. Liferay portlet MVC
- 2.4. Managing users and permissions
- 2.5. Hooks

**3. Apache Tiles as a templating mechanism****4. Spring in web applications**

- 4.1. Spring MVC
- 4.2. Spring Webflow
- 4.3. Spring Data JPA
- 4.4. Spring Security

**5. Vaadin GUI framework**

- 5.1. How Vaadin works
- 5.2. Vaadin and JSF: a comparison
- 5.3. Portlets with Vaadin

[updated 24.02.2018]

**Teaching methods/Media:**

Transparencies with notes, exercises, Kahoot quiz, GlassFish as an application server

[updated 24.02.2018]

**Recommended or required reading:**

Richard Sezov: Liferay in Action

Xinsheng Chang: Liferay 6.2 - User Interface Development

Baumann, Arndt, Engelen, Hardy, Mjartan: Vaadin - Der kompakte Einstieg für Java-Entwickler

Craig Walls: Spring im Einsatz

*[updated 24.02.2018]*

## Introduction to Astronomy

<b>Module name (EN):</b> Introduction to Astronomy
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ASTR
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  <i>[updated 05.10.2020]</i>
<b>Applicability / Curricular relevance:</b>  KI674 (P200-0008) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, non-technical KIB-ASTR (P200-0008) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, non-technical KIB-ASTR (P200-0008) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, non-technical MAB.4.2.1.3 (P200-0008) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 5, optional course MST.EAS (P200-0008) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 5, optional course, non-technical MST.EAS (P200-0008) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , semester 5, optional course, non-technical MST.EAS (P200-0008) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 5, optional course, non-technical PIBWN25 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, not informatics specific PIB-ASTR (P200-0008) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , 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 01.10.2022]*

**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]

**Module offered in:**

WS 2023/24

## Introduction to Parallel Programming with CUDA

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

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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  
PIBW139 (P222-0074) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course,  
informatics specific  
PIB-CUDA Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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 Single-Board Computers

<b>Module name (EN):</b> Introduction to Single-Board Computers
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-EE
<b>Hours per semester week / Teaching method:</b> 2V+2PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> according to optional course list
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project, paper with presentation  [updated 23.11.2020]
<b>Applicability / Curricular relevance:</b>  KIB-EE (P221-0071) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , optional course, informatics specific KIB-EE (P221-0071) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , optional course, informatics specific PIB-EE (P221-0071) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b>

None.

**Recommended as prerequisite for:**

**Module coordinator:**

Prof. Dr. Peter Birkner

**Lecturer:** Prof. Dr. Peter Birkner

[updated 01.10.2022]

**Learning outcomes:**

After successfully completing this module, students will be familiar with the basics and concepts of single-board computers:

- They will understand the differences between a computer and a microcontroller.
- They will be familiar with the most important application areas of such miniature computers.
- Students will be more familiar with the software and hardware.
- They will be able to perform simple measurement and control tasks with a single-board computer.
- They will understand the concept of a cluster and learn the basics of MPI based on the example of a Raspberry Pi Zero cluster.

[updated 23.11.2020]

**Module content:**

- Introduction ( Why use single-board computers at all? History and development, differences between Raspberry Pi and Arduino, important applications)
- Hardware (Models, processors, connectors, compute modules, general purpose input output, sensors, firmware)
- Software (Operating systems, brief introduction to UNIX, Wolfram Mathematica, Raspi as web server)
- Network (Raspi as VPN gateway, SSH, Samba client)
- IoT (Raspi as Z-Wave controller with FHEM)
- Programmierung (Assembler, scripting languages, Python, C)
- The GPIO interface (experiments with the OnBoard LED, temperature sensors, HATs)
- The I2C bus
- A Raspberry Pi cluster consisting of 4 Raspberry Pi Zeroes (overview, installation and configuration)
- Introduction to parallel programming with MPI (Message Passing Interface) and the Raspberry Pi cluster

Other possible topics:

- Emulating a Raspberry Pi
- Single-board computers from other manufacturers

[updated 23.11.2020]

**Recommended or required reading:**

[still undocumented]

**Module offered in:**

WS 2023/24



# Introduction to Wireless LANs

<b>Module name (EN):</b> Introduction to Wireless LANs
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-WLAN
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam (90 min.)  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  E2428 (P200-0033) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, technical KI632 (P200-0033) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-WLAN (P200-0033) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-WLAN (P200-0033) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBW120 (P200-0033, P610-0199) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-WLAN (P200-0033) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>

**Module coordinator:**

Dipl.-Math. Wolfgang Braun

**Lecturer:** Dipl.-Math. Wolfgang Braun

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## IT Forensics

**Module name (EN): IT Forensics****Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022**Module code:** KIB-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 specificKI690 (P221-0083) Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014 , semester 5, optional course, technicalKIB-ITF Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021 , semester 5, optional course, technicalKIB-ITF Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022 , semester 5, optional course, technicalPIBW154 (P221-0083) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specificPIB-ITF Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN): IT Forensics Practical Course</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ITFP
<b>Hours per semester week / Teaching method:</b> 2P (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 26.02.2018]
<b>Applicability / Curricular relevance:</b>  KI601 (P221-0084) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , optional course, technical KIB-ITFP <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-ITFP <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBW166 (P221-0084) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , optional course, informatics specific PIB-ITFP <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, informatics specific
<b>Workload:</b> 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 01.10.2022]

**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

<b>Module name (EN): IT Security Project</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PITS
<b>Hours per semester week / Teaching method:</b> 4PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> English/German
<b>Assessment:</b>  [still undocumented]
<b>Applicability / Curricular relevance:</b>  KI633 (P221-0088) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-PITS (P221-0088) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-PITS (P221-0088) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBW189 (P221-0088) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-PITS (P221-0088) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific  Suitable for exchange students (learning agreement)
<b>Workload:</b>

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 01.10.2022]

**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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-KGR

**Hours per semester week / Teaching method:**

3V+1U (4 hours per week)



<p><b>ECTS credits:</b> 5</p>
<p><b>Semester:</b> 5</p>
<p><b>Mandatory course:</b> no</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b></p> <p>[updated 19.12.2023]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>BMT2505.KGR (P221-0197) <u>Biomedical Engineering, Bachelor, ASPO 01.10.2018</u> , semester 5, optional course  E2588 (P221-0197) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , semester 5, optional course  KIB-KGR (P221-0197) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course  MAB_19_4.2.1.39 (P221-0197) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019</u> , semester 5, optional course  MST2.KGR (P221-0197) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 5, optional course  PIB-KGR (P221-0197) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course</p>
<p><b>Workload:</b> 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.</p>
<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> <u>Prof. Dr. Michael Kleer</u></p>
<p><b>Lecturer:</b> <u>Prof. Dr. Michael Kleer</u></p> <p>[updated 24.10.2023]</p>
<p><b>Learning outcomes:</b> 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.</p>

[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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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 01.10.2022]

**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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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

[updated 26.02.2018]

**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 (P221-0085, P610-0536) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional

course, informatics specific  
PIB-MLRN (P221-0085) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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, 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 26.02.2018]

**Module content:**

Machine learning plays an increasingly important role with applications ranging from recognizing handwritten digits, via filtering out unwanted spam 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 and k-medoids
- Hierarchical agglomerative/divisive clustering
- Evaluation

### 6. Outlook

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

[updated 26.02.2018]

#### **Recommended or required reading:**

P. Harrington: Machine Learning in Action, Manning, 2012

G. James, D. Witten, T. Hastie, R. Tibshirani: An Introduction to Statistical Learning - with Applications in R, Springer, 2015

A. C. Müller and S. Guido: Introduction to Machine Learning with Python, O'Reilly, 2017

M. J. Zaki und W. Meira Jr.: Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, 2014

[updated 26.02.2018]

## **Mathematical Software Systems and Algorithmic Applications**

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

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-MSAA

**Hours per semester week / Teaching method:**

4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Case studies/Project collection  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI637 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-MSAA <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-MSAA <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBW191 (P221-0117) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-MSAA <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Barbara Grabowski</u>
<b>Lecturer:</b> <u>Prof. Dr. Barbara Grabowski</u>  [updated 01.10.2022]
<b>Learning outcomes:</b> 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: elementary algorithms, A.K.Peters Ltd., 2002

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

[updated 19.02.2018]

## Measurements and Simulations in Communications Engineering

<b>Module name (EN): Measurements and Simulations in Communications Engineering</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-MSNT
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b>  [still undocumented]
<b>Applicability / Curricular relevance:</b>  KI698 (P222-0077) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-MSNT <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-MSNT <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIB-MSNT <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , 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 01.10.2022]

**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

<b>Module name (EN):</b> Mentoring
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-MENT
<b>Hours per semester week / Teaching method:</b> 2S (2 hours per week)
<b>ECTS credits:</b> 2

<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Seminar paper  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  BMT2590.MEN <u>Biomedical Engineering, Bachelor, ASPO 01.10.2018</u> , semester 5, optional course KI591 (P200-0018) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, non-technical KIB-MENT (P200-0018) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, non-technical KIB-MENT (P200-0018) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, non-technical MAB.4.2.1.15 (P200-0018) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 3, optional course PIBWN39 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, not informatics specific PIB-MENT (P200-0018) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, not informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Simone Odierna</u>
<b>Lecturer:</b> <u>Prof. Dr. Simone Odierna</u>  [updated 01.10.2022]
<b>Learning outcomes:</b> After successfully completing this module, the students will have acquired the following competences: <ul style="list-style-type: none"> <li>- They will know, understand and be able to explain the structure of mentoring programs</li> <li>- They will know and understand theories of conversation techniques and be able to apply them during consultations</li> <li>- They will be able to plan and conduct consultations and group discussions</li> <li>- They will be able to reflect upon and optimize their consulting competences</li> <li>- They will be able to build new networks</li> </ul>

(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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

<b>Module code:</b> KIB-KISB
<b>Hours per semester week / Teaching method:</b> 4PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> according to optional course list
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Short paper and presentation  [updated 24.02.2018]
<b>Applicability / Curricular relevance:</b>  KI578 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , optional course, technical KIB-KISB <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , optional course, technical KIB-KISB <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , optional course, technical PIBW122 (P221-0119) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , optional course, informatics specific PIB-KISB <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 6, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr.-Ing. Ahmad Osman</u>
<b>Lecturer:</b> <u>Prof. Dr.-Ing. Ahmad Osman</u>  [updated 01.10.2022]
<b>Learning outcomes:</b> 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)

<b>Module name (EN):</b> Mobile Application Development (Android)
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-MADA
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Exercises, project and presentation  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI599 (P221-0086) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-MADA <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-MADA <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBW142 (P221-0086) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-MADA <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> <u>KIB-PRG3</u> Programming 3  [updated 01.10.2022]
<b>Recommended as prerequisite for:</b>



<p><b>Module coordinator:</b> <u>Christoph Karls, M.Sc.</u></p>
<p><b>Lecturer:</b> <u>Christoph Karls, M.Sc.</u></p> <p>[updated 01.10.2022]</p>
<p><b>Learning outcomes:</b> 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.</p> <p>[updated 19.02.2018]</p>
<p><b>Module content:</b></p> <ul style="list-style-type: none"> <li>- Basics</li> <li>- Programming environment &amp; special toolchain</li> <li>- Activities and life cycle</li> <li>- User interfaces</li> <li>- Intents and broadcast receiver (communication between application components)</li> <li>- Services and threads</li> <li>- Persistence</li> <li>- Content provider</li> <li>- Sensors and actuators</li> <li>- Miscellaneous</li> </ul> <p>[updated 19.02.2018]</p>
<p><b>Teaching methods/Media:</b> Android smartphones and tablets, transparencies, projector, board, project and group work, lecture-relevant exercises, oral presentations by students</p> <p>[updated 19.02.2018]</p>
<p><b>Recommended or required reading:</b> <a href="http://www.android.com">http://www.android.com</a> <a href="http://developer.android.com">http://developer.android.com</a> MarkL.Murphy,Commonsware,TheBusyCoder_sGuide to Android Development - <a href="https://commonsware.com/Android/">https://commonsware.com/Android/</a></p> <p>[updated 19.02.2018]</p>

## Numerical Software

<p><b>Module name (EN):</b> Numerical Software</p>
<p><b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u></p>

<b>Module code:</b> KIB-NUMS
<b>Hours per semester week / Teaching method:</b> 2V+2PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> according to optional course list
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Case studies and micro-projects with the applications discussed  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI672 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-NUMS (P221-0087) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , optional course, technical KIB-NUMS (P221-0087) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , optional course, technical MST.NSW (P221-0087) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , optional course, technical MST.NSW (P221-0087) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , optional course, technical MST.NSW (P221-0087) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , optional course, technical PIBW192 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-NUMS (P221-0087) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , optional course, informatics specific MST.NSW (P221-0087) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011</u> , optional course, technical
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Gerald Kroisandt</u>

**Lecturer:** Prof. Dr. Gerald Kroisandt

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Preparing for the IELTS Test

**Module name (EN):** Preparing for the IELTS Test

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

<b>Module code:</b> KIB-IEL
<b>Hours per semester week / Teaching method:</b> 2VU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam (75%), oral examination (25%)  [updated 05.10.2020]
<b>Applicability / Curricular relevance:</b>  BMT2640.IELTS (P213-0041) <u>Biomedical Engineering, Bachelor, ASPO 01.10.2018</u> , semester 6, optional course KIB-IEL <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, non-technical KIB-IEL <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, non-technical MAB_19_2.1.2.24 (P213-0041) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019</u> , optional course, general subject MST.IEL (P213-0041, P231-0133) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 6, optional course MST.IEL (P213-0041, P231-0133) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , semester 6, optional course MST.IEL (P213-0041, P231-0133) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 6, optional course PIB-IEL <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 6, optional course, not informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Christine Sick</u>

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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 learned to solving the tasks set in the examination.

[updated 05.10.2020]

**Module content:**

- \_ Structure and parts of the Academic IELTS test
- \_ Listening comprehension and 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

<b>Module name (EN): Presenting a Project</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-SSP
<b>Hours per semester week / Teaching method:</b> 2V (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Oral presentation with grade  [updated 24.02.2018]
<b>Applicability / Curricular relevance:</b>  KI574 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, non-technical KIB-SSP <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, non-technical KIB-SSP <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, non-technical PIBWN33 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, not informatics specific PIB-SSP <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, not informatics specific  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.

<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> <u>Prof. Dr. Christine Sick</u>
<b>Lecturer:</b> <u>Prof. Dr. Christine Sick</u>  [updated 01.10.2022]
<b>Learning outcomes:</b> 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]
<b>Module content:</b> - 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]
<b>Teaching methods/Media:</b> Teaching and learning materials for specific target groups (print, audio, video)  [updated 24.02.2018]
<b>Recommended or required reading:</b> 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

<b>Module name (EN): Principles of Web Development</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-WEB
<b>Hours per semester week / Teaching method:</b> 2V+2U (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KIB-WEB (P221-0023) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course KIB-WEB (P221-0023) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course PIB-WEB (P221-0023) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, mandatory course  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>



**Module coordinator:**  
Prof. Dr. Maximilian Altmeyer

**Lecturer:** Prof. Dr. Maximilian Altmeyer

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

# Programming Tools

<b>Module name (EN):</b> Programming Tools
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-PRGW
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project  [updated 24.02.2018]
<b>Applicability / Curricular relevance:</b>  DFBI-443 (P610-0254) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2018</u> , optional course, informatics specific DFIW-PWZ (P610-0193) <u>Computer Science and Web Engineering, Bachelor, ASPO 01.10.2019</u> , semester 4, mandatory course, informatics specific KI569 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, informatics specific KIB-PRGW <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-PRGW <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBW113 (P221-0124) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-PRGW (P221-0124) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>

**Module coordinator:**  
Prof. Dr. Reinhard Brocks

**Lecturer:** Prof. Dr. Reinhard Brocks

[updated 01.10.2022]

**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 Programmierwerkzeuge,  
<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

<b>Module name (EN): Risk-Based Decision Making and Statistical Data Analysis</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ERSD
<b>Hours per semester week / Teaching method:</b> 2V+2P (4 hours per week)
<b>ECTS credits:</b> 4
<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Written exam  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI626 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-ERSD (P221-0107) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-ERSD (P221-0107) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical PIBWI94 (P221-0106) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-ERSD (P221-0107) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific
<b>Workload:</b> 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 01.10.2022]

**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]

**Module offered in:**  
WS 2023/24

## Robotics Lab Course

**Module name (EN):** Robotics Lab Course

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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 01.10.2022]*

**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:**

I. 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

<b>Module name (EN): Ruby on Rails</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-RUBY
<b>Hours per semester week / Teaching method:</b> 3V+1P (4 hours per week)
<b>ECTS credits:</b> 4
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>  KI680 (P221-0091) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical KIB-RUBY <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, technical KIB-RUBY <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, technical PIBWI72 (P221-0091) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, informatics specific PIB-RUBY <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, informatics specific
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>



**Module coordinator:**  
Dipl.-Inf. Julian Fischer

**Lecturer:** Dipl.-Inf. Julian Fischer

[updated 01.10.2022]

**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

JOSÉ 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

<b>Module name (EN):</b> Running RoboNight Workshops
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-ROBO
<b>Hours per semester week / Teaching method:</b> 1PA+1S (2 hours per week)
<b>ECTS credits:</b> 3
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> English/German
<b>Assessment:</b> Participation in 5 classes, 3 workshops, the competition + a written composition  [updated 24.02.2018]
<b>Applicability / Curricular relevance:</b>  KI628 (P200-0007) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, non-technical KIB-ROBO (P221-0182) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, non-technical KIB-ROBO (P221-0182) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, non-technical MST.RNW (P200-0007) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , optional course, non-technical MST.RNW (P200-0007) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , optional course, non-technical MST.RNW (P200-0007) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , optional course, non-technical PIBWN58 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, not informatics specific PIB-ROBO (P221-0182) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, not informatics specific MST.RNW (P200-0007) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2011</u> , optional course, non-technical  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.

<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> Prof. Dr. Steffen Knapp</p>
<p><b>Lecturer:</b> Prof. Dr. Steffen Knapp  [updated 01.10.2022]</p>
<p><b>Learning outcomes:</b> 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]</p>
<p><b>Module content:</b> - 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]</p>
<p><b>Teaching methods/Media:</b> 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]</p>
<p><b>Recommended or required reading:</b> - 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]</p>

## Russian for Beginners 1

<p><b>Module name (EN):</b> Russian for Beginners 1</p>
<p><b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u></p>
<p><b>Module code:</b> KIB-RFA1</p>

<p><b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)</p>
<p><b>ECTS credits:</b> 2</p>
<p><b>Semester:</b> 6</p>
<p><b>Mandatory course:</b> no</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Written exam</p> <p>[updated 19.02.2018]</p>
<p><b>Applicability / Curricular relevance:</b></p> <p>EE-K2-524 (P200-0020) <u>Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012</u> , semester 5, optional course, non-technical  EE-K2-524 (P200-0020) <u>Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015</u> , semester 5, optional course, non-technical, course inactive since 14.03.2018  E2426 (P200-0020) <u>Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018</u> , optional course, non-technical  KI607 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, non-technical  KIB-RFA1 (P200-0020) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 6, optional course, non-technical  KIB-RFA1 (P200-0020) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 6, optional course, non-technical  MAB.4.2.1.21 (P200-0020) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2013</u> , semester 6, optional course  MAM.2.1.1.20 (P610-0556) <u>Engineering and Management, Master, ASPO 01.10.2013</u> , optional course, general subject, course inactive since 06.10.2020  PIBWN38 (P200-0020) <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 6, optional course, not informatics specific  PIB-RFA1 (P200-0020) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 4, optional course, not informatics specific</p>
<p><b>Workload:</b> 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.</p>
<p><b>Recommended prerequisites (modules):</b> None.</p>
<p><b>Recommended as prerequisite for:</b></p>
<p><b>Module coordinator:</b> <u>Prof. Dr. Christine Sick</u></p>

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Russian for Beginners 2

**Module name (EN):** Russian for Beginners 2

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 (P200-0020, P200-0021) Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012 , semester 6, optional course

EE-K2-525 (P200-0020, 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 (P200-0021) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, not informatics specific

PIB-RFA2 Applied Informatics, Bachelor, ASPO 01.10.2017 , 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:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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.russlandjournal.de](http://www.russlandjournal.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

<b>Module name (EN): Semiconductor Technology and Production</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-HLTP
<b>Hours per semester week / Teaching method:</b> 4V (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> 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 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN): Sino-German Student Club for Smart Sensors</b>
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-SGSC
<b>Hours per semester week / Teaching method:</b> 1V+3PA (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work  [updated 19.02.2018]
<b>Applicability / Curricular relevance:</b>

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 01.10.2017 , 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 01.10.2022]

**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. Wiczorrek, 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

<b>Module name (EN):</b> Software Development for Collaborative Industrial Robots
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-IROB
<b>Hours per semester week / Teaching method:</b> 4PA (4 hours per week)
<b>ECTS credits:</b> 5

<b>Semester:</b> 5
<b>Mandatory course:</b> no
<b>Language of instruction:</b> English/German
<b>Assessment:</b> Project with presentation  [updated 06.11.2020]
<b>Applicability / Curricular relevance:</b>  KI566 <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 5, optional course, technical KIB-IROB (P221-0132) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , semester 5, optional course, technical KIB-IROB (P221-0132) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , semester 5, optional course, technical MST.SKI (P221-0132) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2012</u> , semester 5, optional course, technical MST.SKI (P221-0132) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2019</u> , semester 5, optional course, technical MST.SKI (P221-0132) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , semester 5, optional course, technical PIBWI08 <u>Applied Informatics, Bachelor, ASPO 01.10.2011</u> , semester 5, optional course, informatics specific PIB-IROB (P221-0132) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , semester 5, optional course, informatics specific  Suitable for exchange students (learning agreement)
<b>Workload:</b> 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.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> Prof. Dr. Steffen Knapp
<b>Lecturer:</b> Prof. Dr. Steffen Knapp  [updated 01.10.2022]
<b>Learning outcomes:</b> 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 06.11.2020]

**Module content:**

During this course, students will cover how to program six-axis collaborative industrial robots. The goal is the development of plugins using a system-dependent script language.

First Part (lectures, practical exercises):

- Safety aspects when using industrial robots
- Dealing with robot hardware
- System dependent script language (with UR as an example)
- Development of system-specific plug-ins UR CAPS (using UR as an example)

Second Part (project):

Development of plug-ins for integration into the control software of the robots to solve common industrial problems (e.g. assembly processes, Pick&Place)

[updated 06.11.2020]

**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](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]

## Spanish for Beginners I

**Module name (EN): Spanish for Beginners I**

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 01.10.2017 , 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:**

KIB-SFA2 Spanish for Beginners II

[updated 01.10.2022]

**Module coordinator:**  
Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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]

**Module offered in:**

WS 2023/24

## Spanish for Beginners II

<b>Module name (EN):</b> Spanish for Beginners II
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-SFA2
<b>Hours per semester week / Teaching method:</b> 2SU (2 hours per week)
<b>ECTS credits:</b> 2
<b>Semester:</b> 6
<b>Mandatory course:</b> no
<b>Language of instruction:</b> 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 01.10.2017 , 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):**

KIB-SFA1 Spanish for Beginners I

[updated 01.10.2022]

**Recommended as prerequisite for:****Module coordinator:**

Prof. Dr. Christine Sick

**Lecturer:** Prof. Dr. Christine Sick

[updated 01.10.2022]

**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 24.02.2018]

### **Module content:**

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 19.02.2018]

**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]

**Module offered in:**

WS 2023/24

## Systems Engineering

**Module name (EN):** Systems Engineering

**Degree programme:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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  
PIBW134 Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 5, optional course, informatics specific  
PIB-SYSE (P221-0184) Applied Informatics, Bachelor, ASPO 01.10.2017 , 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:**

KIB-BS Operating Systems

[updated 01.10.2022]

**Module coordinator:**

Prof. Dr. Martin Buchholz

**Lecturer:** Prof. Dr. Martin Buchholz

[updated 01.10.2022]

**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:** Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022

**Module code:** KIB-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 08.05.2008]

**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

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 01.10.2017 , 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 01.10.2022]

**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

<b>Module name (EN):</b> The Impact of Gender and Diversity on Careers and Studies
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-GD
<b>Hours per semester week / Teaching method:</b> 2V+2S (4 hours per week)
<b>ECTS credits:</b> 5
<b>Semester:</b> according to optional course list
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project (E-portfolio) with presentation (possible as group work)  [updated 21.12.2023]
<b>Applicability / Curricular relevance:</b>  KIB-GD (P241-0411) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2021</u> , optional course, non-technical KIB-GD (P241-0411) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , optional course, non-technical MAB_19_4.2.1.31 (P241-0411) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019</u> , optional course, general subject MST2.GDB (P241-0411) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , optional course PIB-GD (P241-0411) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , optional course, not informatics specific
<b>Workload:</b> 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 01.10.2022]

**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)

<b>Module name (EN):</b> The Impact of Gender and Diversity on Careers and Studies (Submodule)
<b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u>
<b>Module code:</b> KIB-GDT
<b>Hours per semester week / Teaching method:</b> -
<b>ECTS credits:</b> 3
<b>Semester:</b> according to optional course list
<b>Mandatory course:</b> no
<b>Language of instruction:</b> German
<b>Assessment:</b> Project work (e-portfolio)  [updated 19.12.2023]
<b>Applicability / Curricular relevance:</b>  BMT2583.AGDT (P213-0188) <u>Biomedical Engineering, Bachelor, ASPO 01.10.2018</u> , semester 5, optional course EE1640 (P213-0188) <u>Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2022</u> , optional course FT72 <u>Automotive Engineering, Bachelor, ASPO 01.10.2019</u> , optional course KIB-GDT (P213-0188) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u> , optional course MAB_19_4.2.1.37 (P213-0188) <u>Mechanical and Process Engineering, Bachelor, ASPO 01.10.2019</u> , optional course MST2.GDBT (P213-0188) <u>Mechatronics and Sensor Technology, Bachelor, ASPO 01.10.2020</u> , optional course PIB-GDT (P213-0188) <u>Applied Informatics, Bachelor, ASPO 01.10.2017</u> , optional course
<b>Workload:</b> The total student study time for this course is 90 hours.
<b>Recommended prerequisites (modules):</b> None.
<b>Recommended as prerequisite for:</b>
<b>Module coordinator:</b> Sandra Wiegand, M.A.

<p><b>Lecturer:</b> Sandra Wiegand, M.A.</p> <p><i>[updated 31.08.2023]</i></p>
<p><b>Learning outcomes:</b></p> <p><i>[updated 19.12.2023]</i></p>
<p><b>Module content:</b></p> <p><i>[updated 19.12.2023]</i></p>
<p><b>Recommended or required reading:</b></p> <p><i>[updated 19.12.2023]</i></p>

## Web Security Project

<p><b>Module name (EN):</b> Web Security Project</p>
<p><b>Degree programme:</b> <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2022</u></p>
<p><b>Module code:</b> KIB-PWS</p>
<p><b>Hours per semester week / Teaching method:</b> 1V+1PA (2 hours per week)</p>
<p><b>ECTS credits:</b> 3</p>
<p><b>Semester:</b> 6</p>
<p><b>Mandatory course:</b> no</p>
<p><b>Language of instruction:</b> German</p>
<p><b>Assessment:</b> Project, presentation, documentation</p> <p><i>[updated 12.04.2018]</i></p>
<p><b>Applicability / Curricular relevance:</b></p> <p>KI614 (P221-0089) <u>Computer Science and Communication Systems, Bachelor, ASPO 01.10.2014</u> , semester 6, optional course, technical</p>

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  
PIBW162 (P221-0089) Applied Informatics, Bachelor, ASPO 01.10.2011 , semester 6, optional course, informatics specific  
PIB-PWS Applied Informatics, Bachelor, ASPO 01.10.2017 , 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 01.10.2022]

**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]*