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Faculty of Computer Science and Business Information Systems

Technical University of Applied Sciences Würzburg-Schweinfurt

# Module Handbook

# Bachelor Business Information Systems (B. Sc.)

Winter semester 2026
Summer semester 2026



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Technical University of Applied Sciences Würzburg-Schweinfurt

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# 1. semester

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# Module: 9999999
# General Compulsory Elective

## Module profile

**Exam number**
9999999

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Jochen Seufert

**Lecturer(s)**
Beate Wassermann

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 1. semester |
| **Type of module** | AWPM |

**Required prerequisites for the participation in the module according to the SPO**
As a rule, none; exceptions are determined and announced by the Faculty of Applied Natural Sciences and Humanities.

**Recommended prerequisites for the participation in the module**
none

**Content**
A choice of two compulsory elective general science modules (AWPF) (2 x 2 SWS) or one AWPF (1 x 4 SWS) from the range of modules offered by the Faculty of Applied Natural Sciences and Humanities (FANG).

Subjects offered by FANG in the following areas:
- Languages
- Cultural Studies
- Natural Sciences and Technology
- Politics, Law and Economics
- Education, Psychology and Social Sciences
- Soft Skills
- Creativity and Art.

Courses whose content is already part of, or directly related to, other modules in the degree programme are excluded from the FANG course catalogue. The relevant courses are marked as ‘restricted’ in the FANG course catalogue.
The content of the individual AWPFs is published on the FANG faculty’s own website.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
The subject-specific learning objectives depend on the AWPFs selected in each case. Students

- also acquire knowledge and skills that are not subject-specific but may be relevant to their intended career path, such as specialised knowledge of foreign languages, the natural sciences or the social sciences
- analyse a wide variety of issues
- place subject-specific knowledge within an interdisciplinary context
- apply what they have learnt to their current training
- have expanded their key competences and, where applicable, their foreign language skills, thereby supporting their personal development, including from an intercultural perspective
- are aware of their responsibilities in personal, social and ethical terms.

**Literature**
depending on the selected AWPFs

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# Module: 5011030
# Discrete Mathematics and Linear Algebra

## Module profile

**Exam number**
5011030

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Andreas Keller

**Lecturer(s)**
Albrecht Onasch

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 1. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
School maths

**Content**
Linear Algebra:
Systems of linear equations, matrices, vectors, scalar product, matrix operations, inverse matrices, determinants.

Logic:
Logical operators, truth tables, propositional algebra, normal forms.

Number theory:
Modular arithmetic, extended Euclidean algorithm, Euler–Fermat's theorem, RSA encryption.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**

- Students are familiar with fundamental concepts and techniques from the mathematical fields of propositional logic, number theory and linear algebra.
- Students understand the significance of mathematical methods and their role in applications within the fields of business informatics and e-commerce, such as in the calculation of IBAN check digits, the implementation of the RSA public-key encryption scheme, and the simplification of complex logical expressions in conditional queries within programmes.
- Students apply mathematical techniques to solve practical problems in the fields of business informatics and e-commerce.
- Students analyse mathematical problems in the fields of propositional logic, number theory and linear algebra in order to develop and implement suitable solution strategies.
- Students evaluate different solution strategies in terms of their effectiveness and efficiency in solving specific mathematical problems.
- Students devise their own solution strategies to successfully tackle mathematical problems.

**Literature**

Bartholomé, Andreas; Rung, Josef; Kern, Hans: Number Theory for Beginners; Vieweg + Teubner, Wiesbaden
Beutelspacher, Albrecht; Zschiegner, Marc-Alexander: Discrete Mathematics for Beginners; Vieweg + Teubner, Wiesbaden
Brill, Manfred: Mathematics for Computer Scientists; Hanser Verlag; Munich/Vienna
Gramlich, Günter: Linear Algebra – An Introduction; Fachbuchverlag Leipzig, published by Carl Hanser Verlag
Hartmann, Peter: Mathematics for Computer Scientists; Vieweg + Teubner, Wiesbaden
Papula, Lothar: Mathematics for Engineers and Scientists 1 and 2; Vieweg + Teubner; Wiesbaden
Pommersheim, James E.; Marks, Tim K.; Flapan, Erica L.: Number Theory: A Lively Introduction with Proofs, Applications, and Stories; John Wiley & Sons
Schubert, Matthias: Mathematics for Computer Scientists; Vieweg + Teubner, Wiesbaden

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# Module: 5000440,6910010 Introduction to Computer Science

## Module profile

**Exam number**
5000440,6910010

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 30 hrs

*Self-study: 120 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Peter Braun

**Lecturer(s)**
John Zhong Wang

| | |
|---|---|
| **Applicability** | BDGD, BWI |
| **Semester according to SPO** | 1. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This module teaches the fundamentals of computer science to students not specialising in core computer science.

- Information, information content, information encoding, representation of numbers and characters, text encoding, date formats, colour information
- Binary arithmetic, Boolean algebra and logic gates
- Models and modelling as a fundamental principle in computer science, abstraction, reduction, decomposition, aggregation
- Description of data structures using the extended Backus–Naur form
- Modelling of dynamic systems and their description using finite automata and state diagrams
- Formal languages, regular grammars and the word problem
- Further automata models: Moore and Mealy automata
- The concept of an algorithm, computability, the halting problem, the operation and programming of Turing machines
- Basic algorithms for searching and sorting
- History of hardware development
- Structure and basic operation of a computer and microprocessor; von Neumann architecture; Moore's Law
- Structure and operation of the Internet and the World Wide Web
- Introduction to HTML and Markdown
- Architecture of distributed systems, client-server, peer-to-peer, blockchain, Git
- History of artificial intelligence, machine learning methods, regression, how neural networks work
- Data protection and ethics in computer science

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**

- Students recall fundamental concepts of information processing and are able to measure the information content of messages.
- Students understand data encoding and basic modelling methods within computer science.
- Students apply methods for describing data structures.
- Students analyse simple dynamic systems and describe them using state diagrams.
- Students construct regular grammars and solve the word problem using finite automata.
- Students analyse simple problems and devise solutions using Turing machines.
- Students recall key points in the history of computer science.

**Literature**

- Gumm, Heinz-Peter; Sommer, Manfred: Introduction to Computer Science, 10th edition, Oldenbourg, 2012.
- Ernst, Hartmut; Schmidt, Jochen; Beneken, Gerd: Basic Course in Computer Science: Fundamentals and Concepts for Successful IT Practice, 8th edition, Springer Verlag, 2023.

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# Module: 5011010
# Basics of Programming

## Module profile

**Exam number**
5011010

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Tobias Fertig

**Lecturer(s)**
Prof. Dr.-Ing. Tobias Fertig, John Zhong Wang

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 1. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The Programming I module focuses on learning procedural programming as well as the basics of object-oriented programming in the Java programming language. The ability to programme and thereby independently solve minor problems in various fields is one of the fundamental skills expected of a (business) IT specialist.

The course consists of 13 lessons, comprising tutorial videos, accompanying exercises, PowerPoint slides relating to the videos, and quizzes covering the material.

The tutorial videos are structured in such a way that students gradually become familiar with the various language constructs and fundamental concepts of programming. The accompanying seminar sessions are designed for students to ask questions and gain a deeper understanding of the material.

The exercises are by far the most important component of the course. Students learn to programme by solving problems independently. The exercise sessions are helpful in that the lecturer provides food for thought when a student gets stuck on a task, and the quality of solutions is discussed and improved. The exercises generally relate to the preceding tutorial videos and build on their content.

Each lesson includes a quiz which, through simple questions, gives students the opportunity to check whether they know or understand the material covered.

Contents:
- Introduction/First programme (Hello World)
- Basic language constructs (expressions, primitive variables, assignments)
- Essential (control) statements (conditional statements, branching, head- and tail-controlled loops)
- Methods, recursion, arrays, complex data types
- Object-oriented programming (introduction), classes, objects, (instance) methods, visibility
- Multidimensional arrays, behaviour of reference types, string methods, garbage collector

- Data structures (singly and doubly linked lists, binary trees, traversing trees)
- Packages, implicit inheritance, relations using the `equals` method as an example
- DRY principle, ‘Tell, don’t ask’ principle
- Optional: bitwise operators

- IDE used: Eclipse

This module forms the basis for Programming 2 and the programming project. Furthermore, the content and skills acquired in this module significantly facilitate the Programming 3 module and are useful for

- Mathematical Software in Computer Science
- Algorithms and Data Structures 2
- Operating Systems
- Fundamentals of Distributed Systems
- Data Management & Data Science

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
bZv – currently suspended

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to

- apply procedural programming and, at an introductory level, the basics of object-oriented programming
- independently develop a solution strategy for writing small procedural and object-oriented Java programmes based on a given design concept
- understand simple mathematical and technical problems and implement a solution
- generalise sub-problems using appropriate methods

**Literature**
Heinisch, Cornelia; Müller-Hofmann, Frank; Goll, Joachim: Java as a First Programming Language; From Beginner to Professional; Springer Vieweg, 2023
Christian Ullenboom: Java is Also an Island, 17th, updated and revised edition, Rheinwerk Computing, 2023
Reinhard Schiedermeier: Programming with Java, Pearson Studium – IT, 2010

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# Module: 5000430
# Introduction to Business Information Systems

## Module profile

**Exam number**
5000430

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Karsten Huffstadt

**Lecturer(s)**
Marvin Tessitore

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 1. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The 'Fundamentals of Business Informatics' module introduces key concepts, systems and ways of thinking at the interface between business administration and information technology. Students learn how information systems are used to support, manage and drive innovation in business processes, and what role they play in digital business models. The module provides a fundamental understanding of the architecture, functioning and strategic importance of business IT systems – ranging from ERP systems and databases to current developments such as cloud computing and the platform economy. The aim is to lay a solid foundation for understanding and actively shaping digital value creation.

Specific topics covered include:
- The concept and objectives of business informatics
- Components of business information systems
- Structure and application of ERP systems
- Introduction to business process modelling (e.g. BPMN)
- Basic concepts of data processing and database technology
- Information management and IT infrastructure within organisations
- Digitalisation and automation of business processes
- IT-based decision support systems (BI, MIS)
- Current topics: cloud computing, platform economy, AI-based systems (insight)
- Legal and ethical aspects of digital information systems (data protection, GDPR, bias)

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students...

- list key terms, models and systems in business informatics (e.g. information systems, ERP, databases, processes). (to remember)
- explain the structure, functions and interaction of business information systems and their relevance to organisations. (to understand)
- apply selected methods (e.g. business process or data modelling) to simple scenarios. (to apply)
- distinguish between different types of systems and analyse their use in the context of business processes and digital business models. (to analyse)
- assess the opportunities and challenges of digital transformation and system integration from a business perspective. (to evaluate)
- design simple models to represent business processes or information flows. (to create)

**Literature**
Schmoll, M. (2022). Introductory Course in Business Informatics: A Concise and Practice-Oriented Introduction. Springer Vieweg.
Hess, T., & Ludwig, S. (2020). Introduction to Business Informatics. Vahlen Verlag.
Thome, R. (ed.) (2023). Business Informatics: Fundamentals. De Gruyter Oldenbourg.
Heinrich, L. J., & Riedl, R. (2019). Information Management. De Gruyter Oldenbourg.

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# Module: 5000510,6910050
# Basics of Economics

## Module profile

**Exam number**
5000510,6910050

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Eva Wedlich

**Lecturer(s)**
Prof. Dr. Eva Wedlich

| | |
|---|---|
| **Applicability** | BDGD, BWI |
| **Semester according to SPO** | 1. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
Fundamentals and Key Terms in Business and Economics
- The significance of economic activity
- Types of goods
- Economic principles
- Economic sectors
- Factors of production

Key performance indicators
- Productivity
- Economic efficiency
- Return on equity
- Return on total capital
- Return on turnover

Site selection
Legal forms
- Partnerships and limited companies

Fundamentals of management accounting
Price formation in markets
- Household demand
- Firm supply

National accounts
Economic objectives

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**

- Students are familiar with and understand the key fundamentals and most important interrelationships in economics and business administration.
- Students understand the fundamental principles of economic models and are able to explain them in the context of simple economic scenarios

.

- Students apply key performance indicators, are able to calculate and analyse them, and evaluate them according to the economic scenario.
- Students apply basic techniques for analysing economic data in order to produce simple economic forecasts.
- Students evaluate economic relationships and are able to understand them.
- Students understand how to analyse and correctly evaluate economic texts (including those from business newspapers).

**Literature**

Bofinger, P.: Principles of Economics: An Introduction to the Science of Markets, 2019
Mankiw, G.; Taylor, M.: Principles of Economics; 8th ed.; Schäffer-Poeschel, Stuttgart, 2021
Balderjahn, I.; Specht, G.: Introduction to Business Administration: 8th ed., Schäffer-Poeschel, Stuttgart, 2020
Vahs, D.; Schäfer-Kunz, J.: An Introduction to Business Administration; 9th ed.; Schäffer-Poeschel, Stuttgart, 2025
Wöhe, G.: An Introduction to General Business Administration; 28th ed.; Vahlen; Munich, 2023

# 2. semester

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# Module: 5011040
# Analysis

## Module profile

**Exam number**
5011040

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Andreas Keller

**Lecturer(s)**
Prof. Dr. Andreas Keller

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 2. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
School mathematics, linear algebra and discrete mathematics

**Content**
This module covers fundamental aspects of single-variable calculus and their application to selected topics in mathematical economics.

Mathematical Foundations/Real Numbers
Properties of functions
Sequences
Limits of functions and continuity
Differential calculus
Integral calculus
Application of calculus to selected topics in mathematical economics.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students are able to explain basic concepts (e.g. domain, codomain, range) and properties (injectivity/surjectivity/bijectivity, invertibility, monotonicity, etc.) in relation to various standard types of functions (polynomials, power functions (roots), rational functions, exponential and logarithmic functions). They can calculate fundamental limits of sequences and functions. Using the concept of limits, they are also able to examine functions for continuity and differentiability and, by way of examples, understand the geometric properties of continuous or differentiable functions and the useful consequences (including the Intermediate Value Theorem, the zero-point theorem, L'Hospital's rule, etc.) can be derived from these properties.
They can confidently differentiate the standard types of functions mentioned above using the rules of differentiation, and determine local and global extrema. As a practical numerical method, they apply Newton's method as an example.
Students are familiar with the concept of the definite (Riemann) integral and the elementary rules for calculating it. In addition, they are familiar with the concept of the indefinite integral (primitive function) as well as the integral function (a foundation for statistics and probability theory) and the connection with differential calculus, in particular the fundamental theorem of calculus. Specifically, they are able to calculate elementary indefinite and definite integrals and to use integral calculus, for example, to calculate areas or to determine generalised averages.
Students know how to apply the knowledge of analysis they have acquired to selected problems in financial and economic mathematics, such as compound interest calculations (continuous compounding), annuity calculations, marginal cost and marginal function, and elasticity.

In general, students assess the suitability of mathematical methods for specific problems, check results for plausibility and interpret them within a subject-specific context.

Through the continuous solving of problems and working through mathematical texts, students strengthen their capacity for logical, analytical and conceptual thinking and develop strategies for structured problem-solving.

**Literature**
Brill, Manfred: Mathematics for Computer Scientists; Hanser Verlag; Munich/Vienna
Ihrig, Holger; Pflaumer, Peter: Financial Mathematics – Intensive Course; Oldenbourg Verlag; Munich;
Hartmann, Peter: Mathematics for Computer Scientists; Vieweg + Teubner, Wiesbaden
Papula, Lothar: Mathematics for Engineers and Scientists 1 and 2; Vieweg + Teubner; Wiesbaden
Schubert, Matthias: Mathematics for Computer Scientists, Vieweg + Teubner, Wiesbaden
Tietze, Jürgen: Introduction to Financial Mathematics, Vieweg + Teubner, Wiesbaden

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# Module: 5001310
# Databases

## Module profile

**Exam number**
5001310

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank-Michael Schleif

**Lecturer(s)**
Michael Rott

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 2. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
bZv

**Recommended prerequisites for the participation in the module**
none

**Content**
This module covers the fundamental concepts and techniques of database development. The relational data model and relational algebra are presented as the theoretical foundations. A key focus is on database modelling, in particular the creation of entity-relationship models (ER models) and their conversion into relational schemas, taking normal forms into account. An introduction to the SQL language is provided, including data manipulation, data querying, schema definition and transaction management. Database development and administration are practised through practical exercises and projects running throughout the semester.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**

- Students can explain the basic concepts of data persistence and the differences between persistent and non-persistent data.
- Students can define the key terms of relational databases, such as relation, primary key, foreign key and normalisation.
- Students understand relational algebra and can apply simple operations to it.
- Students can explain the relationship between conceptual, logical and physical data modelling and justify their significance for database development.
- Students are able to create entity-relationship models (ERM) for given use cases and convert these into relational schemas.
- Students can formulate and execute SQL queries for data manipulation (DML) and schema definition (DDL).
- Students can analyse existing database schemas and evaluate them in terms of redundancy, consistency and normal forms.
- Students are able to analyse business information requirements and derive suitable data structures and queries from them.

**Literature**


- Michael Kofler (2024). Database Systems – The Comprehensive Textbook (2nd edition). Bonn: Rheinwerk Verlag GmbH
- Kemper, A., & Eickler, A. (2015). Database Systems – An Introduction (10th edition). Munich: De Gruyter Oldenbourg Verlag
- Elmasri, R., & Navathe, S. B. (2015). Fundamentals of Database Systems (7th edition). Munich: Pearson Studium
- Garcia-Molina, H., Ullman, J. D., & Widom, J. (2013). Database Systems: The Complete Book (2nd ed.). Upper Saddle River, NJ: Pearson
- Saake, G., Sattler, K.-U., & Heuer, A. (2011). Databases – Concepts and Languages (3rd edition). Munich: Pearson Studium

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# Module: 5000910,6910120
# English for IT

## Module profile

**Exam number**
5000910,6910120

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Graeme Dunphy

**Lecturer(s)**
Beate Wassermann,
Andrea Kreiner-Wegener

| | |
|---|---|
| **Applicability** | BDGD, BWI |
| **Semester according to SPO** | 2. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Approx. 6 years of English at school, level B2

**Content**
technical vocabulary; reading, understanding and working with technical texts (e.g. project descriptions, extracts from IT magazines, authentic technical reading material); listening comprehension (authentic recordings on computer-related topics); oral communication skills (e.g. telephone calls, presentations, discussions, negotiations, meetings); written communication (particularly emails)

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Students have sufficient English language skills to enable them to work or study in an English-speaking country without encountering any significant language difficulties.
Course level B2 (CEFR)

**Literature**
lecture notes, various articles, listening materials

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# Module: 5011060
# Basics of Artificial Intelligence

## Module profile

**Exam number**
5011060

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Ivan Yamshchikov

**Lecturer(s)**
Prof. Dr. Ivan Yamshchikov

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 2. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This seminar provides an introduction to the fundamentals of Artificial Intelligence (AI) and its wide range of potential applications. In this seminar, students will gain a basic understanding of how AI systems work and their use in various fields. As the seminar progresses, various AI systems will be presented, tested by students and the associated implications for the digital society discussed.

Introduction to Artificial Intelligence (AI)

Overview: The development of AI over recent decades.
Concepts: The difference between symbolic AI (logic-based) and sub-symbolic AI (data-based).
Classical methods: Early models such as Adatron, Boltzmann machines, Hopfield networks and cellular automata.
Knowledge representation: Introduction to semantic networks, ontologies and (fuzzy) logic.

Key concepts and principles of Machine Learning (ML)

Types of learning: Supervised, unsupervised and reinforcement learning.
Learning objectives: Predictions (regression/classification) and knowledge discovery (clustering/density estimation).
Formalisation: The mathematical description of the learning problem.
Ethics: Societal implications and ethical issues surrounding ML.

Fundamentals of learning from data
Objective function: The loss function.
Risk: Expected and empirical risk in learning.
Model complexity: Overfitting and underfitting.
Process: Training, validation and testing of models.
Evaluation: How to evaluate models and select the best one.

Selected Machine Learning Algorithms
Linear models: For predicting values or categories.
Regularisation: Methods such as ridge regression to avoid errors.
Variable selection: Sparse models (e.g. Lasso) for identifying important data features.

Mixture models: K-means clustering and Gaussian mixture models (GMM).
Non-parametric methods: Kernel methods, decision trees and random forests.

Programming for machine learning
Languages: Practical work with Python.

Tools: Use of key libraries such as NumPy, Pandas, Scikit-learn and Jupyter Notebooks.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students recall the fundamental terms, concepts and historical developments associated with the term 'artificial intelligence' (AI).
Students understand how AI systems work from a technical perspective and what key components – such as machine learning, neural networks and decision trees – play a role in this.
Students apply simple AI tools independently in order to gain a practical understanding of how they work and to explore specific application scenarios.
Students analyse the areas of society in which AI is already being used and identify the functional differences between various AI systems.
Students assess the opportunities and risks associated with the use of AI in areas such as education, public administration, healthcare and transport.
Students develop their own ideas for the application of AI technologies in society and reflect on their social relevance.
Students identify the everyday digital products in which AI is used and how these applications are designed.
Students understand the ethical, legal and social implications associated with the use of autonomous or machine-learning systems.
Students analyse how AI is changing our conceptions of autonomy, responsibility and decision-making.

**Literature**
1. Bishop, Christopher M. Pattern Recognition and Machine Learning. Information Science and Statistics. New York: Springer, 2006.
2. Murphy, Kevin P. Machine Learning: A Probabilistic Perspective. Adaptive Computation and Machine Learning Series. Cambridge, MA: MIT Press, 2012.
3. Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. The Elements of Statistical Learning. Springer Series in Statistics. New York, NY, USA: Springer New York Inc., 2001.
4. Russel, S, Norwig, P. Artificial Intelligence: A Modern Approach, Pearson, 2022

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# Module: 5011110
# Logistics and Sales

## Module profile

**Exam number**
5011110

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Eva Wedlich

**Lecturer(s)**
Prof. Dr. Eva Wedlich

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 2. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Fundamentals of Economics

**Content**
- Introduction to logistics
- Procurement logistics
- Procurement methods, quantities and lead times
- Warehouse logistics
- Production logistics
- Capacity planning, availability checks
- Distribution logistics
- Market and sales research methods
- Products and product ranges
- Marketing mix
- Methods of customer order fulfilment (make-to-stock, make-to-order, etc., drop shipping)
- Methods of availability checking
- Online marketing

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students recall fundamental terms and concepts in logistics, including procurement logistics, warehouse logistics and distribution logistics.
Students apply concepts of capacity planning to carry out basic availability checks.
Students evaluate various warehousing strategies in terms of their efficiency and costs and compare their impact on the entire supply chain.
Students develop simple logistics strategies for a given scenario and integrate knowledge from the fields of procurement and production logistics.
Students are familiar with practical tasks, understand the workflows and processes in an industrial setting, and are able to solve problems within industrial constraints by addressing, analysing and resolving marketing and sales-related issues using real-world case studies.
Students have knowledge of the core concepts of marketing and sales.
Students acquire the ability to analyse sales-related issues.
Students are familiar with marketing tools and can apply them.

**Literature**
Geyer, Helmut: Crash Course in Marketing, 5th edition, 2023
Winkelmann, Peter; Spandl, Torsten: Marketing and Sales: Foundations for Market-Oriented Business Management, 9th edition, 2023
Wannenwetsch, A.: Integrated Procurement, Logistics, Materials Management and Production: The Supply Chain in the Age of Digitalisation, Springer-Verlag, 6th edition, 2021.

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# Module: 5011020
# Object-oriented Software Development

## Module profile

**Exam number**
5011020

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Tobias Fertig

**Lecturer(s)**
Prof. Dr.-Ing. Tobias Fertig, Christine Zilker

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 2. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
bZv

**Recommended prerequisites for the participation in the module**
Programming I

**Content**
The Programming II module focuses on learning object-oriented programming (in the Java programming language). In order to structure larger information systems, it is important to learn how they can be built, designed and tested.

This course consists of 13 lessons, comprising tutorial videos, accompanying exercises, PowerPoint slides relating to the videos, and quizzes covering the material.

The instructional videos are structured so that students are first presented with tests and then gradually learn about object-oriented programming and its application. The accompanying seminar sessions provide an opportunity to ask questions and consolidate the material.

The exercises are by far the most important part of the course. By solving problems independently, students learn object-oriented programming. The exercise sessions are helpful in that the lecturer provides students with food for thought when a student gets stuck on a task, and the quality of solutions is discussed and improved. The practical sessions generally relate to the preceding tutorial videos and build on their content.

Each lesson includes a quiz which, through simple questions, gives students the opportunity to check whether they know or understand the material covered.

Contents:
Unit tests (JUnit 5)
Dependency management (Maven)
Inheritance (specialisation, generalisation)
Enumerations
Abstract classes, interfaces, composition
Exceptions
Streams
Generics
Collections, associative arrays (Maps)
Nested classes (static nested, inner, local, anonymous classes)
Lambda expressions

Threads
Design patterns: Builder, Decorator, Visitor
Fluent interfaces
Functional programming using the Stream API

IDE: Eclipse or IntelliJ

The content and skills acquired in this module will make the ‘Programming 3’ module and the programming project considerably easier and are useful for

- Mathematical Software in Computer Science
- Algorithms and Data Structures 2
- Operating Systems
- Fundamentals of Distributed Systems
- Data Management & Data Science

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to

- apply concepts of object-oriented programming
- independently develop a solution strategy for writing object-oriented Java programmes
- implement partial solutions to larger programmes or problems
- to structure problems into several sub-problems
- to implement tests for software systems
- to understand and use polymorphism in methods and types
- to use class libraries to extend programmes
- to understand basic design patterns

**Literature**
Schiedermeier, Reinhard: Programming with Java. Pearson, 2nd edition, 2010.
Schiedermeier, Reinhard: Programming with Java II. Pearson, 2013.
Bloch, Joshua: Effective Java. 3rd edition, Addison-Wesley, 2017.
Ullenboom, Christian: Java is also an island. 16th edition, Rheinwerk Computing, 2021.

# 3. semester

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# Module: 5011190
# Business Process Management

## Module profile

**Exam number**
5011190

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Gabriele Saueressig

**Lecturer(s)**
Michael Rott,
Prof. Dr. Gabriele Saueressig

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 3. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Fundamentals of Business Informatics

**Content**
Business Processes: Fundamentals
Fundamental Concepts of Business Process Management
Business Process Modelling
- The importance of business process modelling
- Process description and documentation
- Models and model types
- Reference process models
- Enterprise process models
- Process map
- Principles of proper modelling
- EPK – Event-Driven Process Chains
- BPMN – Business Process Modelling Notation

Business Process Analysis and Optimisation
Process Organisation and Process Controlling
Process Mining
Workflow Management
Exercises in process modelling using EPK and BPMN

The theoretical content is complemented by practical presentations and workshops, e.g. on process mapping and analysis, and on specific topics in the field of business process management.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- understand issues, methods and techniques in the field of business process management
- model business processes using various modelling languages
- apply fundamental approaches to process mapping, analysis and optimisation

Subject-specific competences:

- Students deepen their understanding of the fundamentals of business informatics by applying and practising basic knowledge and methods of business process management
- Students are familiar with the methods and design principles involved in the conception, design and optimisation of business processes and are able to apply them
- Students acquire the fundamental ability to model and map business processes
- Students gain an understanding of the issues and challenges in business process management
- Students learn key skills for using techniques and methods in business process management and are able to apply these to simple problems

Interdisciplinary skills:

- In the practical sessions, students will become familiar with and learn to use modelling tools that can also be effectively applied in other modules
- Students will be able to apply the methods they have learnt independently and outline solution scenarios using practical examples

**Literature**
Aalst, Wil van der; Hee, Kees van: Workflow Management – Models, Methods, and Systems, The MIT Press.
Allweyer, T.: “Business Process Management: Strategy, Design, Implementation, Controlling”, W3L.
Allweyer, T.: BPMN 2.0 – Business Process Model and Notation: An Introduction to the Standard for Business Process Modelling, books on demand.
Dumas, M., La Rosa, M., Mendling, J., Reijers, H.A.: Fundamentals of Business Process Management, Springer.
European Association of Business Process Management (EABPM) (eds.): “BPM CBOK – Business Process Management Common Body of Knowledge, Version 3.0, A Guide to Process Management”, Verlag Dr. Götz Schmidt.
Fischermanns, G.: “Practical Handbook of Process Management”, Verlag Dr. Götz Schmidt.
Freund, J., Rücker, B.: Practical Handbook of BPMN: with an Introduction to DMN, Carl Hanser Verlag GmbH & Co. KG.
Gadatsch, Andreas: “Basic Course in Business Process Management”; Vieweg; Wiesbaden.
Reinkemeyer, L.: “Process Mining in Action: Principles, Use Cases and Outlook”, Springer Nature.

Schmelzer, H.J., Sesselmann, W.: ‘Business Process Management in Practice’, Hanser.

The current edition of the listed literature applies in each case. Further reading will be announced during the course.

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# Module: 5011160
# Data Science

## Module profile

**Exam number**
5011160

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank-Michael Schleif

**Lecturer(s)**
Prof. Dr. Frank-Michael Schleif

| | |
|---|---|
| **Applicability** | BWI, BIN |
| **Semester according to SPO** | 3. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
Database systems, courses in programming and software engineering

**Content**
Most of the work in data science, and most of the risk, lies before a model is
fitted. This module focuses on that part: how data is generated, what is wrong
with it, what can legitimately be concluded from it, and how to express this in a way
that stands up to scrutiny. No models are trained; the module ends where a
machine learning course begins. The subject matter is explored using a real
production database rather than a prepared teaching example, so the defects
encountered are the defects that actually occur.

Core Topics:

- Data and its origin: data, information, knowledge, decision; levels of scale and
the operations each permits; provenance and what it implies for quality.
- Tabular data: the ‘tidy data’ principle and its violations; reshaping; join
types and cardinality; referential integrity on write and on read.
- From query to pipeline: operative versus dispositive data; database interfaces; parameterised queries; repeatable extraction with provenance.
- Formats, metadata and protection: CSV, XML, JSON, YAML, Parquet and HDF5;
encoding and quoting defects; schema on write versus schema on read;
querying hierarchical data; data dictionary, FAIR, personal data and the distance to anonymity.
- Data quality: systematic profiling; missing values as MCAR, MAR and MNAR; defect
classes based on the effort required for detection and correction; outliers; selection,
survivorship and labelling bias; cleaning decisions recorded along with their risk.

- Data beyond the table: time series as a distinct data class (resampling,

aggregation windows, gaps, smoothing); graph models (neighbourhood,

centrality, components, querying a property graph).
- Features, similarity and distance: encoding and scaling; Euclidean, cosine,

Jaccard, dynamic time warping and edit distance; metric axioms; feature

engineering as the choice of an embedding.
- Reduction and structure: PCA, explained variance and loadings; what t-SNE

optimises and what may never be discerned from its output; k-means and spectral

clustering.
- Exploratory analysis and visualisation: location and spread appropriate to the

distribution; Pearson versus Spearman, correlation versus causation; chart

type selected based on the question; misleading axes and scales; validated colour.
- Communication and readiness: dashboard versus analysis tool; what a model

expects; splits and data leakage; readiness criteria and justifying a decision.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion, students will be able to:

Knowledge and Understanding:
- Explain the implications of a scale level for the operations it permits
- Explain the tidy data principle, and how join cardinality affects rows
- Distinguish between MCAR, MAR and MNAR, and identify selection, survivorship and

labelling bias
- Explain what a model observes, and what data leakage is and how it arises

Skills and Competences:
- Convert a query into a repeatable, parameterised extraction with a provenance

record
- Profile a dataset for types, completeness, cardinality, duplicates and

plausibility
- Work with time series and graph data using the operations required for each
- Choose and apply an encoding, a scaling and a distance measure suited to the

features
- Determine which statements a projection, a clustering or a dashboard supports and

which it does not
- Produce a documented analysis dataset with a specified unit of observation and a

cleaning log, and justify a ‘go’ or ‘no go’ verdict on its readiness

**Literature**
- Skiena (2017), *The Data Science Design Manual*, Springer (available via the

university library)
- VanderPlas (2023), *Python Data Science Handbook*, 2nd edition, O'Reilly
- McKinney (2022), *Python for Data Analysis*, 3rd edition, O’Reilly
- Wickham (2014), ‘Tidy Data’, *Journal of Statistical Software* 59(10)
- Wilkinson et al. (2016), The FAIR Guiding Principles for Scientific Data

Management and Stewardship, Scientific Data 3
- Robinson, Webber and Eifrem (2015), Graph Databases, 2nd edition, O’Reilly
- Munzner (2014), Visualisation Analysis and Design, CRC Press
- Kaufman, Rosset and Perlich (2012), Leakage in Data Mining, ACM Transactions

on Knowledge Discovery from Data 6(4)
- Tukey (1977), Exploratory Data Analysis, Addison-Wesley

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# Module: 5003230,6810160
# IT Project Management

## Module profile

**Exam number**
5003230,6810160

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Anne Heß

**Lecturer(s)**
Prof. Dr. Eva Wedlich,
Prof. Dr.-Ing. Anne Heß

| | |
|---|---|
| **Applicability** | BISD, BWI |
| **Semester according to SPO** | 3. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**

- Introduction to projects and project management
- Project organisation
- Project planning process
- Project costing
- Project control and monitoring
- Project closure
- Human resources management and project marketing
- IT product management
- Core activities in IT projects (analysis, design, implementation, integration and stabilisation)
- Quality management and quality assurance
- Configuration management (basic)
- Process models (phase-based models vs. iterative / incremental / agile process models)
- Agile project management / Scrum

In the non-dual degree programme, the lecturer determines the topics for the practical examples used in seminars and examinations. In the dual degree programme, students can work on practical examples from the company in seminars and examinations.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**

- Students acquire project management skills, in particular the knowledge required of project managers. To this end, the course covers project management methods, processes and tools.
- Students are familiar with the key activities involved in software development and their objectives
- Students are able to identify and describe the sub-activities, prerequisites and types of deliverables associated with these key activities
- Students can describe various process models (waterfall model, V-model, Scrum), including their respective advantages and disadvantages, and can describe and map activities within these process models
- Students understand the characteristic features and differences between phase-oriented process models and iterative/incremental process models, and can select suitable process models for a given project context and justify their choice
- Students are familiar with the fundamental principles, roles, artefacts, ceremonies and practices of agile projects (using Scrum as an example) and can find their feet as a team member in an agile project
- Students understand the importance and relevance of software quality
- Students are familiar with key concepts of quality management and quality assurance and can describe the relevant tasks and skills (soft skills) of quality officers
- Students are familiar with the key objectives, concepts and activities of configuration management, including the basic functionalities of tools designed to support configuration management

**Literature**

- Johannsen, A. and Kramer, A.: Essential Knowledge for Software Project Managers, dpunkt.verlag, 2017.
- Olfert, K.: Project Management, NWB Verlag, 11th edition, 2019.
- Sterrer, C. and Winkler, G.: Setting Milestones. Project Management (Methods, Processes, Tools), Goldegg Verlag, 2010.
- Sterrer, C.: pm k.i.s.s.: Keep it short and simple, Goldegg Verlag, 2011.
- Tiemeyer, E.: Handbook of IT Project Management, Hanser, 2018
- Ziegler, Michael: Agile Project Management with Scrum for Beginners, ISBN-13: 979-8751100346, 2021
- Gundlach, Marco: Agile Project Management – Navigating Successfully with Scrum and Kanban: A Comprehensive Guide for Beginners and Experts, ISBN-13: 979-8392911936, 2023

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# Module: 5000730,6910170
# Innovation Management and Entrepreneurship

## Module profile

**Exam number**
5000730,6910170

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Michael Müßig

**Lecturer(s)**
Prof. Dr. Michael Müßig

| | |
|---|---|
| **Applicability** | BDGD, BWI |
| **Semester according to SPO** | 3. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The 'Innovation Management and Business Start-ups' seminar offers a practical and comprehensive course that motivates students not only professionally but also personally, and prepares them for the real-world challenges of the business world. At the start of the course, the fundamentals of innovation management are covered. This includes an understanding of the various types of innovation — such as incremental and disruptive innovations — as well as the importance of an innovative mindset in modern organisations. Schumpeter and Christensen are also introduced, with their contributions examined in their respective historical contexts. Models and theories by Alexander Osterwalder, such as the Business Model Canvas, are covered in detail to provide students with a robust tool for visually structuring and analysing business ideas. Design Thinking is introduced as an essential method. Interactive workshops support students in developing creative solutions to problems, with a focus on user needs. The practical application of Design Thinking in real-world case studies enables a deep understanding of iterative processes and prototyping. In the area of business start-ups, the focus is on start-up strategies and business planning for digital business models. Topics such as market analysis, competitive analysis and financing options are covered, as are the legal framework conditions for setting up a business. First-hand accounts from guest lecturers — including successful founders — enrich the theoretical content and bring it to life. Through elements of growth hacking and the 'scale-up' context, the course also addresses the steps following the start-up phase on the path to becoming a successful business.
Particular emphasis is also placed on the requirements of sustainable technologies and business models. The issue of digital sovereignty is also examined and discussed.
A practical project (the Innovation Challenge, in collaboration with the Centre for Digital Innovation in Würzburg) provides additional motivation for students. Working in teams, they develop their own business idea, create a Business Model Canvas and finally present their idea to a 'panel of investors' in a pitch simulation. This final project not only offers practical experience but also strengthens students' confidence in their ideas and their feasibility. Through a combination of theoretical knowledge, practical workshops and personal development, students are comprehensively prepared to put

their own ideas into practice and make their contribution to digital transformation and innovation. This practical project also introduces students to the region's start-up ecosystem (ZDI, Start-up Award, start-up networking events, etc.).

A variety of case studies deepen the practical relevance (Tesla, Kodak and digital photography, Fashion and TEC – using examples such as BOSS, Scoutbee, Vogel Communications, WeSort.AI, Faaren...).

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students will recall key concepts in innovation management and business start-ups, such as the Business Model Canvas and Design Thinking.
Students will understand the principles and benefits of an innovative mindset, as well as the role it plays in modern organisations.
Students apply Design Thinking methods to develop creative solutions to real-world challenges.
Students analyse market and competitive data to identify opportunities and risks for new business ideas.
Students evaluate various funding options for start-ups in order to select the most suitable strategy for implementing their business ideas.
Working in teams, students devise innovative business ideas and develop these into comprehensive business models, which they present in a pitch demonstration.

**Literature**
Compulsory reading:
Hess, Thomas: Strategically Managing Digital Transformation. Springer Fachmedien Wiesbaden GmbH, 2019
Osterwalder, Alexander; Pigneur, Yves et al.: Business Model Generation, campus Verlag, 2011 (and later editions)
Ries, Eric: *The Lean Startup*, 4th ed. Reline-Verlag, Munich, 2015
Michael Lewrick, Patrick Link, Larry Leifer: *Design Thinking: The Handbook*, Vahlen, 2018
Kotsemir, M.; Abroskin, A.; Meissner, D.: Innovation Concepts and Typology – an evolutionary Discussion. Basic Research Programme, Working Papers, SERIES: SCIENCE, TECHNOLOGY AND INNOVATION WP BRP 05/STI/2013

Supplementary reading:
Christensen, Clayton M.: The Innovator’s Dilemma, Harvard Business Review Press (1997 and current editions, also available in German)
Burkhardt, Christoph: Thinking Errors in Innovation; SpringerGabler 2017

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# Module: 5011240
# Sustainability and Digital Transformation

## Module profile

**Exam number**
5011240

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Michael Müßig

**Lecturer(s)**
Prof. Dr. Michael Müßig

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 3. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The world is currently undergoing at least two – and in some cases three or four – transformations.
1) The transformation towards a sustainable economy, which is urgently required due to climate change. This encompasses not only environmental but also economic and social aspects.
2) The need to transform entire businesses, societies and personal environments – driven by digital innovations and amplified by the development of disruptive new business models – constitutes the second level of transformation.
3) Driven by the tsunami of technological developments in artificial intelligence, from generative AI and language models (chats, agents, multi-agent systems, etc.), as well as in 'physical AI' (the combination of environmental sensors, intelligence and the execution of physical activities), we are undergoing a further transformation towards an 'AI world' and
4) Due to geopolitical developments and extreme platform monopolisation ("Big Tech"), there is a further level of transformation towards digital sovereignty.
These sub-areas will be presented, discussed, analysed and organised sequentially, whilst also highlighting their interconnections.

The key background factors, historical developments and political milestones relating to sustainability are examined. The three pillars of economic, environmental and social sustainability are discussed. Terms, trends and business models from this field are presented. The impact of sustainability on IT projects, IT product life cycles and IT systems is addressed. Data sources and standards for sustainability reporting as an IT task are clarified. The module then takes a holistic view of digital transformation, addressing the framework conditions, opportunities and challenges. Through workshops, students learn about examples of successful digital transformations across various sectors. The module answers the following questions, amongst others: What methods and models for digital transformation are available? What do organisational concepts look like that successfully drive digital transformation forward? What characterises digital business models? What examples are there? How can ambidexterity be maintained during digital transformation, thereby allowing the current business model to be retained temporarily? What is meant by dual

transformation? What significance do resilience and sustainability hold for the transformation process?

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
The seminar is structured around the following learning objectives:

- Students explain the three-pillar model of sustainability (environment, economy, society) using specific examples
- Students will be able to apply the three-stage principle (sufficiency, consistency, efficiency) to specific digital business models.
- Students will assess the impact of digitalisation on the achievement of individual SDGs
- Students will distinguish between the concepts of 'sustainability of digitalisation' and 'digitalisation for sustainability'
- Students analyse rebound effects arising from the implementation of digital automation solutions in organisations.
- Students can precisely distinguish between the linear economy, the recycling economy and the circular economy.
- Students can explain the four categories of circular business models (Close, Improve, Monetise, Excite the loop) using specialist terminology.
- Students explain the influence of the degree of digitalisation and data management on the quality of sustainability reporting.

Furthermore

- … students are familiar with methods and tools that are useful in the development and implementation of digital business models and can apply them to a limited extent.
- … they are able to explain the business-specific characteristics of digital goods and the consequences arising from them.
- … they explain various organisational concepts of digitalisation and their advantages and disadvantages.
- … they describe the technological enablers of digital transformation.
- … students understand the background, challenges and opportunities of ambidexterity.

**Literature**
Further recommended reading will be announced during the course

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# Module: 5011140
# Quality centred Software Design

## Module profile

**Exam number**
5011140

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Anne Heß

**Lecturer(s)**
Prof. Dr.-Ing. Tobias Fertig,
Prof. Dr.-Ing. Anne Heß

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 3. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Programming skills

**Content**
The discipline of software development falls within the sub-field of practical computer science and deals with the engineering-based development of software.

Following a historical overview and an examination of the fundamental properties of software, the module provides an overview of all the core activities in software engineering. It covers the following activities in the software life cycle, together with the associated specific methods, techniques and tools:

- Analysis
- Specification
- Design (basic)
- Testing

In addition to these core activities, the following related topics are examined:

- UML modelling
- Open-source software
- Usability / user experience design
- Software quality / quality assurance (testing, reviews / inspections)
- Configuration management (basic)
- Various algorithms and data structures (stacks, queues, lists, graphs, graph algorithms, hash maps and traversal strategies)

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will have acquired the following skills:

- They will understand how software engineering originated and where it fits within the wider field.
- They can discuss the specific characteristics of software that distinguish it from other products.
- They can systematically gather requirements during client meetings and specify them in a structured manner.
- They are able to model requirements using the diagram types provided by UML for analysis (use-case diagrams, class diagrams, activity diagrams, sequence diagrams, etc.).
- You can devise designs using simple UML diagrams.
- You are familiar with the importance, principles and methods for ensuring good usability and a positive user experience in interactive software products.
- You are aware of the significance and sub-categories of software quality and understand the associated implications.
- You are familiar with fundamental quality assurance approaches (analytical versus constructive quality assurance) for software.
- You can plan, design and carry out various testing methods (dynamic versus static testing).
- You are familiar with licensing and business models relating to open source and free software.
- You understand the challenges involved in integrating software components and can carry out basic operations using the git configuration management tool (clone, pull, commit, push, checkout).
- You can name data structures and characterise them in terms of their performance characteristics
- You can identify, analyse and evaluate suitable data structures and algorithms for given use cases

**Literature**
Ludewig, J. and Lichter, H.: Software Engineering – Fundamentals, People, Processes, Techniques, 4th edition, 2023
Sommerville, Ian: Software Engineering. Pearson, 2018
Oestereich, Bernd: Analysis and Design with UML 2.5 / UML 2.5.1; Oldenbourg; Munich, 2013/2020
Rupp, Chris: UML 2 Made Crystal Clear; Hanser; Munich, 2012
McLaughlin: Object-Oriented Analysis and Design from Head to Toe, O'Reilly, 2013

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# Module: 5003031
# Software industry, education and economy in India

## Module profile

**Exam number**
5003031

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Deinzer

**Lecturer(s)**
Prof. Dr. Arndt Balzer,
Prof. Dr. Frank Deinzer

| | |
|---|---|
| **Applicability** | BDGD, BEC, BIN, BISD, BWI |
| **Semester according to SPO** | 3. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
A good command of English

**Recommended prerequisites for the participation in the module**
none

**Content**
FWPM is organising a field trip to Bangalore, India, in the second half of February 2027; participants must cover their own flight costs. Further details will be provided in the course.

Introduction to India and our partner university, Christ University in Bangalore
Selection of topics for the intercultural presentations (e.g. politics, religion, the IT industry) in preparation for the excursion.
Presentation of methods for developing presentations in terms of topic selection, structure and slide design.
Introduction to the topic for the joint projects with students from Christ University, which will be carried out in small groups from October onwards.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
none

**Learning outcomes**
Students recall key facts about India and its significance in the field of information technology.
Students analyse and evaluate differences between Germany and India.
Students use a visually-oriented, free-flowing presentation style in their presentations.
Students apply basic intercultural communication techniques, using India as an example.
Students demonstrate successful collaboration with students from the partner university as part of a technical project.

**Literature**
This will be announced during the seminar, depending on the topics covered.

# 4. semester

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# Module: 5002130
# Business Software

## Module profile

**Exam number**
5002130

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Prof. Dr. Frank Hennermann

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 4. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Marketing and Sales, Logistics, Accounting

**Content**
Fundamentals of Business Software
- Software classification and the software market
- Characteristics and limitations of business software

ERP Live with SAP S/4HANA
- Master data management (supplier, material, customer, bill of materials, etc.)
- Purchase to Pay: procurement processing
- Plan to Produce: Processing of production orders
- Order to Cash: Processing of sales orders
- Quality management in logistics
- Selected functions from accounting
- Selected functions from management accounting
- Selected functions from human resources

Analytics with SAP Lumira

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Participants can describe the fundamentals of business software (such as a classification system for business software or the characteristics of business software). Participants are familiar with the leading providers in the business software market.
Participants understand the limitations of business software.
Participants can apply key functions and business processes within business software systems.
Participants are aware of the difference between business software solutions for large enterprises and those for SMEs.
Participants are aware of the difference between the use of cloud-based solutions and on-premises solutions.
Participants can use an analytics tool to derive insights and key performance indicators from business data.

**Literature**
Gronau, Norbert: Enterprise Resource Planning: Architecture, Functions and Management of ERP Systems, 4th edition, Oldenburg-Verlag, Munich 2021.
Martin Munzel: A Quick Start to SAP, 2nd edition, Espresso-Verlag, Gleichen 2017.
Olaf Schulz: The SAP Basic Course for Beginners and Users, Rheinwerk-Verlag, Bonn 2016.

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# Module: 5001820
# Business Technologies

## Module profile

**Exam number**
5001820

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Gabriele Saueressig

**Lecturer(s)**
Michael Rott,
Prof. Dr. Gabriele Saueressig

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 4. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Business Informatics
Databases

**Content**
Business Processes – Fundamentals
Business Process Modelling

- The importance of business process modelling
- Process description and documentation
- Models and model types
- Reference process models
- Enterprise process models
- Process map
- Principles of proper modelling
- EPK – Event-Driven Process Chains
- BPMN – Business Process Modelling Notation
- Practical exercises in process modelling using EPK and BPMN
- Workflow management

Business Intelligence

- The importance of analytical information systems
- Data warehousing and multidimensional data modelling (overview)
- Introduction to data analysis techniques and data visualisation using low-code platforms

The theoretical content is complemented by practical presentations in the fields of Business Intelligence and Business Process Management, as well as practical exercises.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- understand issues, methods and techniques in the field of business technology management
- model business processes using various modelling languages
- carry out initial, simpler data analysis tasks on company data using appropriate tools

Subject-specific competences:

- Students deepen their understanding of the fundamentals of business informatics by applying and practising basic knowledge and methods of Business Technology Management (business process and workflow management, business intelligence)
- Students are familiar with the methods and design principles involved in the conception, design and optimisation of operational business processes and are able to apply them.
- Students acquire the fundamental ability to model and map business processes.
- Students acquire fundamental knowledge of business intelligence, including data warehousing
- Students acquire fundamental knowledge of data analysis techniques and their application in a BI / corporate context
- Students learn key skills for using techniques and methods in business process management and business intelligence and are able to apply these to simple problems
- Students will gain an understanding of process orientation in a business context
- Students will gain an understanding of the issues and challenges involved in modelling and analysing business data

Interdisciplinary skills:

- In the practical sessions, students become familiar with and learn to use modelling tools that can also be effectively applied in other modules (including the 'Business Technologies' specialisation)
- Students are able to apply the methods they have learnt independently and outline solution scenarios using practical examples

**Literature**
Allweyer, T.: "Business Process Management: Strategy, Design, Implementation, Control", W3L
European Association of Business Process Management (EABPM) (ed.): 'BPM CBOK – Business Process Management Common Body of Knowledge, Version 3.0, A Guide to Process Management', Verlag Dr. Götz Schmidt
Fischermanns, G.: 'Practical Handbook of Process Management', Verlag Dr. Götz Schmidt
Gadatsch, Andreas: "Introduction to Business Process Management"; Vieweg; Wiesbaden
Schmelzer, H.J., Sesselmann, W.: "Business Process Management in Practice", Hanser
Staud, Josef L.: "Business Process Analysis"; Springer; Berlin

Aalst, Wil van der; Hee, Kees van: *Workflow Management – Models, Methods, and Systems*, The MIT Press
Christoph Engels: *Essentials of Business Intelligence*; W3L
Roland Gabriel, Peter Gluchowski, Alexander Pastwa: *Data Warehouse & Data Mining*; W3L
Andreas Bauer, Holger Günzel: *Data Warehouse Systems*; dpunkt
Hans-Georg Kemper, Walid Mehanna, and Carsten Unger: Business Intelligence – Fundamentals and Practical Applications: An Introduction to IT-Based Management Support; Vieweg
The current edition of the listed literature applies in each case. Further reading will be announced during the course.

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# Module: 5003220
# Information and Technology Management

## Module profile

**Exam number**
5003220

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Kristin Weber

**Lecturer(s)**
Michael Rott,
Prof. Dr. Kristin Weber

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 4. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Fundamentals of Business Informatics, IT Organisation and IT Controlling, Databases

**Content**
The Information and Technology Management module consists of two parts.

Part 1 examines selected and changing key topics in business informatics, such as the fundamentals of information and technology management, master data management and data quality, big data and machine learning, as well as the management of information security and IT risks. Current topics are increasingly covered by guest lecturers with practical industry experience.

Part 2 focuses on XML. Topics include the fundamentals of XML, XML standards, the structure of XML documents, the structure of a DDT, XML schema definition, XSLT and XPath.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students explore selected key areas and advanced topics in business informatics in greater depth.
They learn about, independently research and discuss current topics in information and technology management that are in demand in the professional world.
They are able to critically examine technological and organisational trends and assess their strategic and operational significance for business practice.
Students are intended to gain an initial insight into the subject area of XML. This is developed and implemented in a practical manner through practical tasks and tools.

**Literature**
Gochermann, J.: Technology Management – Identifying, Evaluating and Successfully Implementing Technologies, Springer, 2020
Lee, B.: Understanding the Digital and AI Transformation, Springer, 2025
Saage, Sattler, Heuer: Databases: Concepts and Languages; 6th ed.; mitp, 2018
Schuh, G.; Klappert, S. (eds.): Technology Management – Handbook of Production and Management 2, 2nd ed., Springer, 2011
Vonhoegen, H.: An Introduction to XML; 8th ed.; Rheinwerk, 2015
Wirtz, B.: Digital Business – Strategies, Business Models and Technologies, 8th ed., Springer Gabler, 2024

Further recommended reading will be announced during the course

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# Module: 5001010
# Software Development Project

## Module profile

**Exam number**
5001010

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 12 hrs

*Self-study: 138 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Tristan Wimmer

**Lecturer(s)**
Prof. Dr. Peter Braun,
Prof. Dr. Tristan Wimmer

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 4. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
Programming I

**Recommended prerequisites for the participation in the module**
Programming I
Programming II
Databases
Software Development

**Content**
Students are to work in groups to develop their own application. An application could, for example, be a game, a three-tier web application or a similar application. Possible components of the application could include a graphical user interface (including a web interface), a database connection including schema design, network communication, AI, etc.
Furthermore, students will produce documentation (an overview, various use cases, the most important activity and sequence diagrams, etc.).
In the traditional degree programme, the topics for the practical examples used in the assessment are provided by the lecturer or agreed with them. In the dual study programme, a task from a real-world business context is worked on in consultation with the lecturer.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to

- develop their first major application as part of a team of 4–6 people
- apply the programming concepts they have learnt
- carry out and implement project planning
- break down a task into sub-problems.
- to allocate and implement tasks
- to apply knowledge of software design
- to work out or look up the necessary information themselves using appropriate literature

**Literature**
None

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# Module: 5001610
# Statistics and Operations Research

## Module profile

**Exam number**
5001610

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Sabrina Klos

**Lecturer(s)**
Michael Rott,
Prof. Dr. Sabrina Klos

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 4. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Mathematics I and II

**Content**
Statistics

Descriptive Statistics
- Statistical data, frequency distributions
- Measures of central tendency, measures of dispersion
- Correlation and regression analysis

Probability Theory:
- Events and probabilities
- Conditional probability and independence
- Random variables and their distributions, parameters
- Binomial and normal distributions
- Approximation by the normal distribution

Inductive Statistics:
- Confidence intervals
- Statistical tests

Operations Research:
- Linear optimisation, in particular the Simplex method
- Transportation problems
- Non-linear optimisation
- Network planning techniques

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Statistics:
Students are familiar with the fundamental concepts and methods of descriptive statistics, probability theory and inferential statistics. They are able to confidently apply statistical methods to analyse, process and present data, and to interpret the results correctly.

Operations Research:
Ability to create, analyse and critique models
Ability to apply optimisation methods
Ability to write their own programmes to solve optimisation problems

**Literature**
Bamberg, G.; Baur, F. and Krapp, M.: Statistics, Oldenburg Verlag, Munich/Vienna
Bourier, G.: Descriptive Statistics, Gabler Verlag, Wiesbaden
Bourier, G.: Probability Theory and Inferential Statistics, Gabler Verlag, Wiesbaden
Henze, N.: Stochastics for Beginners, Vieweg Verlag, Wiesbaden

Horst, Reiner; Isermann; Heinz; Müller-Merbach, Heiner: Fundamentals of Operations Research I; Springer; Berlin
Runzheimer, Bodo; Cleff, Thomas; Schäfer, Wolfgang: Operations Research I; Linear Programming and Network Planning; Gabler; Pforzheim
Lapin, Lawrence L.: Quantitative Methods for Business Decisions with Cases; Wadsworth Publishing
Neumann, Klaus; Morlock, Martin: Operations Research; Hanser; Munich

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# Module: 5002810
# Business and IT Law

## Module profile

**Exam number**
5002810

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Oliver Ehret

**Lecturer(s)**
Prof. Dr. Oliver Ehret

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 4. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
General Contract Law
Specific Contract Law relating to IT, specialised types of contract
Fundamentals of Copyright Law
Overview of relevant areas of industrial property law
Internet Law
Data Protection Law

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students should be enabled to understand the law, the fundamental legal concepts of our legal system and its basic structures. They should be able to recognise the role that law plays for computer scientists. More specifically, they should be able to understand and contextualise the key principles of general private and public law, as well as concepts relating to IT law. The overview provided of the key areas of law relevant to IT and contractual matters is intended to enable them to identify and assess legal risks, and thereby address them. Students will understand the fundamentals of copyright law, particularly in the field of software and databases, and the principles of data protection, with particular regard to IT.

**Literature**
o Kallwass, Abels: Private Law, Franz Vahlen Publishers, Munich, 24th edition, 2022
o Vogel/Dreier: Software and Computer Law, 1st edition, UTB, Bern/ Stuttgart/Vienna 2008.
o Hoeren: IT Contract Law, 2nd edition, Otto Schmidt, Cologne, 2012.
o Schneider: Computer Law, 10th edition, Beck dtv, Munich, 2012.
o Marly: Practical Handbook on Software Law, 6th edition, C.H.Beck, Munich 2014.
o Härting: Internet Law, 5th edition, Otto Schmidt Publishers, Cologne 2013.
o Hoeren: Lecture Notes on Internet Law, University of Münster, as at April 2014
o Haug: Fundamentals of Internet Law, W. Kohlhammer, 3rd edition, 2016
o Redeker: IT Law, C.H. Beck, 6th edition, 2017
o Schneider: Handbook: IT Law, Otto Schmidt, 5th edition, 2017
o Kühling, Sack, Hartmann: Data Protection Law, C.F. Müller, 2018

# 5. semester

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# Module: 5011250
# Supervised Internship

## Module profile

**Exam number**
5011250

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
1

**ECTS-Credits (CP)**
25.0

**Workload**
*Guided study time:*
Presence time: 15 hrs

*Self-study: 735 hrs*

*Total: 750 hrs*

**Teaching format**
Practice

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Christine Zilker

**Lecturer(s)**
Christine Zilker

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 5. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
> 90 ECTS credits

**Recommended prerequisites for the participation in the module**
•

**Content**
- As part of a larger IT project, the intern must work independently in as many project phases as possible (system analysis, system planning, implementation, system roll-out and testing). This project is expected to last at least 12 weeks.
- Ideally, the intern will familiarise themselves with various departments and areas of the company prior to the project, in order to gain a general understanding of other departments and the company as a whole.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Documentation, Presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
The intern should

- acquire relevant, practical knowledge of business processes
- learn (through guidance) to work independently and on their own initiative on IT projects.
- link the skills acquired during their degree with practical experience
- learn to understand problems and requirements (e.g. client requirements)
- learn to design and implement solutions (e.g. for business processes and/or IT projects)
- Experience working as part of a team.
- Learn about and experience being integrated into the company, its processes and organisational procedures.
- Learn about and experience the professional field of computer science.
- Learn to approach the right points of contact when problems arise.
- See the unwavering commitment to the successful and professional implementation of projects demonstrated in practice.
- Experience excellence and professionalism.
- See how staff are inspired and engaged.
- Recognise and feel the purpose of their work.

**Literature**
It is not possible to provide a general recommendation for reading material

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# Module: 5002350,6101110
# Soft and Professional Skills

## Module profile

**Exam number**
5002350,6101110

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
6

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Christina Völkl-Wolf

**Lecturer(s)**
Prof. Dr. Gabriele Saueressig,
Prof. Dr. Christina Völkl-Wolf,
Aylin Heilsberg,
Katja Hollerbach,
Kerstin Betzel,
Julia Holleber,
Christian Genheimer

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 5. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The module provides students with fundamental theoretical and practical knowledge of key soft and professional skills. Through one-day workshops and seminars, students are introduced to facilitation techniques using the Metaplan method, negotiation techniques based on the Harvard method, the basics of body language, team management, conflict management and the fundamentals of academic work.
In addition to imparting knowledge, the focus is on practical application: in practical exercises, role-plays and group work, students undertake specific tasks and test the effectiveness of various methods. In addition, academic working methods such as formulating research questions, conducting literature reviews, citing sources correctly and producing structured, well-argued academic papers are covered.

Fundamentals of soft and professional skills, in particular
o the importance and areas of application of soft and professional skills in academic study and professional life,
o methodical and reflective behaviour in a professional context.

Facilitation and communication techniques, in particular
o the fundamentals of facilitation,
o facilitation techniques based on the Metaplan method,
o structuring and visualising group processes.

Negotiation techniques, in particular
o the fundamentals of negotiation,
o negotiation techniques based on the Harvard method,
o interest- and solution-oriented communication.

Fundamentals of body language, in particular
o facial expressions, gestures and posture,
o the impact of demeanour and outward appearance,
o the conscious use of non-verbal communication.

Team and conflict management, in particular
o Stages of team development,
o Basic methods of team management,
o Causes and forms of conflict,

o Simple communication and problem-solving strategies in conflict situations.

Fundamentals of academic writing, in particular
o Developing simple academic research questions,
o Fundamentals of literature review,
o Citation rules and avoiding plagiarism,
o Organisation and structure of short academic papers.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- apply facilitation techniques (in particular Metaplan) and negotiation techniques based on the Harvard Method,
- to understand the basics of body language (facial expressions, gestures, posture, appearance) and to use them consciously,
- to design team-building processes and apply team management methods,
- to analyse conflicts within groups and address them using appropriate communication and problem-solving strategies,
- to recognise and reflect on the importance of methodologically sound practice when applying soft and professional skills,
- to develop academic research questions, research suitable sources, cite them correctly and produce a short academic paper independently.

**Literature**
Foppa, K.: Communication. An Introduction to Language and Dialogue. Munich, latest edition.
Schulz von Thun, F.: Talking to One Another (Vol. 1–3), Reinbek, latest edition.
Fisher, R.; Ury, W.; Patton, B.: The Harvard Concept. The Classic Guide to Negotiation Techniques. Frankfurt am Main, latest edition.
Theisen, M. R.: Academic Writing. Technique – Methodology – Form. Munich, latest edition.
Further up-to-date materials and practical examples will be provided in the workshops and seminars.

# 6. semester

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# Module: 5003859
# Agentic AI: Enabling Autonomous and Goal-Driven Intelligence

## Module profile

**Exam number**
5003859

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank-Michael Schleif

**Lecturer(s)**
Dr. Manikandakumar Muthusamy

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Python programming, Fundamentals of AI/ML.

**Content**
This course is designed to introduce students to next-generation AI systems capable of autonomous decision-making, planning, reasoning and self-improvement. Unlike traditional reactive AI models, agentic AI systems can initiate actions, perform multi-step tasks, collaborate with other agents and adapt to dynamic environments. This course equips learners with both theoretical foundations and hands-on experience in building autonomous AI agents.
Learners will explore agent architectures, cognitive models, memory systems, tool-use capabilities, multi-agent collaboration frameworks, and practical agent deployment workflows. Through laboratory exercises using modern frameworks such as Flowise, LangChain, AutoGen Studio, CrewAI and AgentOps, students will build goal-driven agents, evaluators, planners and multi-agent systems. Real-world applications from business automation, sustainability, smart systems and software engineering will be emphasised throughout.
The course concludes with a practical assessment in which participants design, implement and demonstrate a functional autonomous agent. By integrating theory, hands-on experimentation and evaluation, this course provides a strong foundation for applying Agentic AI in academic, industrial and research environments aligned with the green digital transformation.

1. Foundations of Agentic AI
Agentic AI – Autonomous AI vs Traditional AI – Agent lifecycle and capabilities – Types of autonomy in AI systems – Rule-based agents vs LLM-driven agents – Real-world examples of agents – Maturity levels of autonomous systems – Application domains aligned with sustainability and the green digital transition.
Interactive brainstorming: Where can agents be used in business?
2. Agent Architectures, Memory, and Planning
Cognitive architecture: perception, reasoning, memory, action – Memory systems in agents: short-term memory, episodic memory, vector-store memory, long-term memory - Planning systems: task decomposition, tree of thought, planner-executor architecture – Tool invocation and API integration – Evaluator-planner loops – Safety layers and guardrails.
3. Building Autonomous Agents and Tool-using Systems

Agent capabilities: tool use, retrieval augmentation, action loops - Safety, guardrails, and constraints, Using frameworks: LangChain Agents, AutoGen Studio, CrewAI worker-manager roles - Hands-on use cases: Research automation agents - Business workflow agents.

4. Multi-agent Systems, Collaborations, and Workflows

Multi-agent systems: roles & communication, manager-worker architecture, planner-agent-reviewer loops, collaboration strategies: parallel, sequential, cooperative, real-world MAS applications (smart grids, supply chain, robotics)

5. Deployment, Monitoring, Ethics

Deployment workflows (local, cloud) – Logging, monitoring, and evaluation of agents – Safety, ethical issues & governance of autonomous systems – Responsible AI principles for autonomous systems – Real-world challenges: hallucination, error handling, misuse.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
1. Understand and explain the principles, architecture and lifecycle of agentic AI systems, and compare them with traditional AI models.
2. Design and implement autonomous agents using modern frameworks with capabilities such as planning, memory, tool use and reasoning.
3. Evaluate and deploy single-agent and multi-agent systems for real-world applications relating to sustainability, automation and intelligent digital ecosystems.

**Literature**
Textbooks:
Martin Ford, *Architects of Intelligence: The Truth About AI from the People Building It*, 2018.
Stuart J. Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall Series in Artificial Intelligence, 2009
Reference Books:
Kence Anderson, “Designing Autonomous AI: A Guide for Machine Teaching”, O’Reilly Media, Inc., 2022

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# Module: 6322190
# Augmented Reality

## Module profile

**Exam number**
6322190

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Stefan Sauer

**Lecturer(s)**
Stefan Sauer

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This event is organised by the Faculty of Plastics Technology and Surveying (FKV):
(https://geo.thws.de/studium/bachelor-geovisualisierung/studienablauf/modulhandbuch-bgv-ab-ws-202223/)

For the schedule, see: https://geo.thws.de/studium/aktuelle-lehrveranstaltungsplaene/

Augmented and Mixed Reality and their applications
- Implementation of marker-based applications
- Implementation of image-based applications
- Implementation of LBS applications

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
1. Students are familiar with the fundamental concepts of augmented reality (AR) and mixed reality (MR), as well as their areas of application.
2. Students understand the differences between marker-based, image-based and location-based services (LBS) in AR technology.
3. Students apply relevant services to plan and implement AR applications.
4. Students analyse requirements and potential applications for AR applications in relation to various content-based approaches.
5. Students evaluate the effectiveness of different techniques for visualising content in relation to spatial objects and markers.
6. Students independently create AR applications that are both marker-based and image-based, and are able to publish them successfully.
7. Students understand concepts for integrating AR applications into existing systems and services.

**Literature**
Dörner, R.; Broll, W.; Grimm, P.; Jung, B.: Virtual and Augmented Reality (VR/AR): Fundamentals and Methods of Virtual and Augmented Reality. 2nd edition, Springer-Verlag Berlin, Heidelberg, 2019. ISBN 978-3-662-58860-4.
Vetter, M. & Olberding, H.: E-learning material on geovisualisation, [online] smart.vhb.org, 2019/2020.

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# Module: 5003836
# BSI BCM Practitioner and BSI Incident Practitioner

## Module profile

**Exam number**
5003836

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Alexander Schinner

**Lecturer(s)**
Liane Kiesewalter,
Tobias Kasch

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
BCM Practitioners
- Introduction to BCM
- BCM process and phased model
- Standards and regulatory framework
- Initiation, planning and implementation
- Establishing and empowering the BAO
- BIA pre-screening and BIA
- Risk analysis
- Contingency planning (BC strategies, GFPs and WAPs)
- Drills and testing
- Performance review and key performance indicators

Incident Responders
- Introduction to the cyber security network, including the framework for digital first responders, incident responders and incident experts
- Summary of the content of the basic course
- Conduct on the telephone, including non-technical measures
- Threats and types of attack, and an overview of the current threat landscape
- Standard operating procedures
- Handling IT security incidents
- Remote support
- Incident handling for IT systems ‘outside the usual office environment’
- ‘After the incident is before the incident’ – preventive measures

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**

- Teaching the BCMS process in accordance with BSI Standard 200-4, with a practical focus
- Effective detection, analysis and management of security incidents in accordance with BSI standards
- Preparation for the relevant BSI audits within the framework of the Cybersecurity Network (CSN)

**Literature**
https://www.bsi.bund.de/DE/Topics/Companies-and-Organisations/Standards-and-Certification/IT-Basic-Security/Certified-Information-Security/BCM-Practitioner-Training-Courses/BCM-Practitioner-Training-Courses_node.html
https://www.bsi.bund.de/DE/Themen/Unternehmen-und-Organisationen/Informationen-und-Empfehlungen/Cyber-Sicherheitsnetzwerk/Qualifizierung/Vorfall_Praktiker/Vorfall_Praktiker.html

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# Module: 5003816
# Behavioural Pricing

## Module profile

**Exam number**
5003816

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Tobias Aubele

**Lecturer(s)**
Juliane Richter

| | |
|---|---|
| **Applicability** | BEC, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
Students will learn about the influence of prices on consumer behaviour from a psychological perspective. In doing so, they will gain an understanding of the intrapersonal processes involved in the perception, evaluation and retention of price information, and will be able to apply the principles of price psychology themselves.

Contents:
Fundamentals of price management
- Introduction to the price management process
- Basic models of business price theory
- Approaches to price determination

Introduction to behavioural pricing
- Behavioural pricing as a sub-field of behavioural economics
- Psychological processes and constructs for processing price information
- Behavioural science theories on price perception, evaluation and memory

Behavioural Pricing in Practice
- Designing price information from the supplier's perspective
- Price psychology effects and practical examples
- Application of behavioural pricing in various sectors

Opportunities and Limitations of (Behavioural) Pricing
- Empirical price research
- Innovative (digital) pricing approaches from a practical and theoretical perspective
- Ethical and legal aspects of (Behavioural) Pricing

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
General learning objectives:
Students will be familiar with the methodological and ethical aspects of pricing and will be able to evaluate pricing approaches from both a business management and a behavioural economics perspective

Specific objectives:
1. Students understand the behavioural pricing approach and are familiar with the theoretical foundations of the psychological impact of price information.
a. Subject-specific competence: Students are familiar with the fundamentals of behavioural pricing management. They understand the psychological impact of price information at different stages of the purchasing process.
b. Problem-solving and evaluation skills: Students understand the behavioural pricing approach as a sub-discipline of behavioural economics and how it differs from classical price theory.
c. Methodological competence: Students practise interpreting behavioural science and psychological models and applying them to pricing management.
d. Communication competence: Students are able to discuss the concepts and models presented in the lecture precisely and using correct technical terminology.
e. Personal competence: Students can independently deepen their knowledge using specialist articles.

2. Students are able to apply the effects of price psychology themselves and are familiar with various areas of application.
a. Subject-specific competence: Students understand the influence of different pricing parameters on price perception and consumer behaviour.
b. Problem-solving and evaluation skills: Students are able to evaluate price psychology measures in different contexts and explain them on the basis of the relevant theory. They can independently derive suitable price psychology measures and apply them to specific practical cases.
c. Methodological competence: Students are able to apply the effects discussed in the lecture to real-world price-related issues.
d. Communication competence: Students can contribute to discussions on price psychology measures and present their own approaches. In doing so, they communicate precisely, effectively and using correct technical terminology.
e. Social competence: As part of a practical case study, students work effectively as part of a team.
f. Personal competence: Students work independently and creatively, and use feedback to further their personal development.

3. Students are familiar with the business fundamentals of pricing policy.
a. Subject-specific competence: Students understand the significance and decision-making areas of pricing policy. They are familiar with the classic concepts of pricing theory and the approaches to price determination.

b. Problem-solving and evaluation skills: Students are able to correctly contextualise the concepts and approaches of pricing management and apply them to case studies.
c. Methodological skills: Students are familiar with empirical methods for price determination, understand the challenges involved, and can apply selected data collection methods themselves.
d. Personal competence: Students are able to expand on the fundamental concepts covered through independent study of the literature.

4. Students critically examine current trends in pricing management as well as innovative, digital pricing approaches.

**Literature**

Beck, H. (2014). Behavioural Economics – An Introduction (focusing on Chapters 1, 4–6). Wiesbaden: Springer Gabler.
Diller, H., Müller, S., Ivens, B., & Beinert, M. (2021). Pricing: Principles and Processes of Corporate Pricing Policy. Stuttgart: Kohlhammer.
Holzwarth et al. (2020). Applying behavioural science to health and financial decisions. In: Behavioural Economics Guide 2020.
Kopetzky, M. (2015). Price Psychology: Four Steps to Optimised Pricing. Wiesbaden: Springer Gabler.
Krämer, A. (2020). Dynamic and Individualised Prices from a Business and Consumer Perspective. In R. Kalka & A. Krämer (Eds.), Price Communication. Wiesbaden: Springer Gabler.
Mazumdar, T., Raj, S. P., & Sinha, I. (2005). Reference price research: Review and propositions. Journal of Marketing, 69(4), 84–102.
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# Module: 5003843
# Business Data Visualization with Power BI and AI

## Module profile

**Exam number**
5003843

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Isabel John

**Lecturer(s)**
Dr. Soundarabai Beaulah Paulsingh

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
A basic understanding of problem-solving skills, including simple Excel calculations, creating graphs and charts, and a basic understanding of database concepts.

**Content**
This course teaches students how to transform raw business data into actionable insights using Microsoft Power BI through interactive dashboards and AI-driven analytics. Participants gain hands-on experience in data cleaning, transformation, modelling and visualisation, whilst applying AI features – including anomaly detection – to uncover trends and patterns. Students will develop practical expertise in the following areas:

- Foundations of Business Visualisation: Understanding the role of data visualisation in business, an overview of the Power BI environment, data connectivity, and navigating the Power Query Editor.
- Data Preparation and Modelling: Transforming, cleaning and structuring data using Power Query, and building analytical data models with effective relationship management.
- Interactive Dashboard Development: Creating business-focused visuals, applying filters, slicers and drill-throughs, and designing interactive dashboards for exploring insights.
- AI-Enabled Business Insights: Applying Power BI's built-in AI capabilities, such as Key Influencers, Decomposition Tree, Q&A, Smart Narratives and anomaly detection, to explain trends and identify key drivers.
- Case Study: Conducting an end-to-end analysis and developing an interactive Power BI dashboard using a real-world business dataset to generate actionable insights.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
By the end of this course, students will be able to

- Demonstrate an understanding of the principles of business data visualisation and the importance of analytics in decision-making.
- Clean, transform and structure business data using Power Query to ensure reliable and analysis-ready datasets.
- Use Power BI's built-in AI features, including anomaly detection, to explain trends, patterns and key drivers in business data.
- Design and build interactive Power BI dashboards that effectively communicate insights to business stakeholders.

**Literature**
A reading list will be provided as part of the course

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# Module: 5003856
# CANVA – Branding with AI

## Module profile

**Exam number**
5003856

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Christina Völkl-Wolf

**Lecturer(s)**
Verena Rempel

| | |
|---|---|
| **Applicability** | BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Your own laptop, installation of the Pro version or trial version of the CANVA programme.

**Content**
1. Corporate Identity – Strategic
Understanding terminology
CI, CD, brand
Best-practice examples from various sectors, analysis of international brands
Positioning, brand values
Mission & vision
Identity models (e.g. Golden Circle)
Target audience profile (e.g. persona)
Brand personality (mood board, archetype)
Tone and style of language

2. Corporate Design – Visual
Deriving a design system
From brand essence to visual system (designing with Canva)
Logo
Colour palette
Typography
Visual language
Layout principles (grid, white space, composition)

3. Brand development
Creating social media content for the brand
Colour management and the impact of colour
Fonts and typeface design
Photo editing, graphics
Video, Reels, Stories

Development of a brand ecosystem:
Creation of digital and print media such as websites, social media content, audiovisual content, business cards, etc.

Usage scenarios / application:
Self-employment/freelancing: A consistent corporate design helps to project a professional image and set you apart.
Portfolio: Personal branding as a ‘common thread’ creates recognition and demonstrates strategic thinking.

Start-ups & student initiatives: A clear brand identity simplifies communication, fundraising and community building.
Agency work: CI/CD expertise is a key qualification for strategic design processes carried out on behalf of clients.
Research & science: Scientific projects also benefit from a coherent, comprehensible brand identity.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students will develop a comprehensive corporate identity and corporate design
concept for a real-life project of their own or a fictional project/start-up, including visual implementation using Canva and AI applications. The aim is to design a consistent, professional brand image for subsequent real-world application. Proficiency in using CANVA as a design software is a prerequisite.

Students review key concepts of corporate identity and corporate design.
Students understand the importance of strategic brand management for digital communication media.
Students analyse CI/CD systems in terms of target audiences, differentiation and media usage.
Students evaluate design solutions in the context of user experience, media formats and communication objectives.
Students apply the knowledge they have acquired and create a comprehensive corporate identity concept, including a cross-media design system, for their own or a fictional project.

**Literature**
https://www.canva.com/de_de/

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# Module: 5003823
# Computer Networks and Cyber Security

## Module profile

**Exam number**
5003823

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Sebastian Biedermann

**Lecturer(s)**
Siavosh Haghighi Movahed

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This module is designed to provide students with the knowledge and skills required to design, implement and manage secure computer networks.
In this module, students will gain a solid foundation in establishing and maintaining robust network infrastructures. At the same time, the module addresses the critical aspect of securing these networks against potential threats, ranging from cyberattacks to data breaches. Through a combination of theoretical concepts and practical exercises, students will develop the expertise needed to identify vulnerabilities, implement security measures and formulate strategies to safeguard information assets in the interconnected world of computer networks. In addition to providing a broad range of fundamental computer networking and security knowledge relevant to all IT careers, this module will also offer students the opportunity to pursue further self-study and acquire the conceptual knowledge and practical skills required for the Cisco® Certified Network Associate (CCNA®) 200-301 exam.

Indicative content:
- Fundamentals of enterprise campus network design
- Network protocols and models
- Fundamentals of IP routing and switching
- IP addressing (IPv4/IPv6)
- Network security concepts and principles
- Configuring and verifying secure inter-switch connectivity
- Implementing, optimising and securing switched networks
- Implementing secure device access and access control systems
- Defining key security concepts (threats, vulnerabilities, exploits and mitigation techniques)
- Firewall technologies

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of this module, students will be able to:
1. Explain the fundamentals of computer networks and cyber security.
2. Design, implement, configure and troubleshoot highly available, secure and scalable network infrastructures.
3. Implement network security and access control solutions using routers, switches and firewalls.
4. Explain how vulnerabilities, threats and exploits can be mitigated to enhance network security.

**Literature**
1. Students are familiar with the fundamentals of computer networks and the principles of cyber security.
2. Students understand the importance of securing network infrastructures against potential threats and vulnerabilities.
3. Students apply best practice in designing, implementing, configuring and troubleshooting high-availability, secure and scalable network infrastructures.
4. Students understand how threats and exploits can undermine network security and identify measures to mitigate these risks.
5. Students evaluate network security solutions, including access control measures implemented via routers, switches and firewalls.
6. Students develop comprehensive strategies to secure information assets and maintain robust network infrastructures, drawing on theoretical knowledge and practical exercises.
7. Students develop the practical skills required to prepare for the 200-301 Cisco® Certified Network Associate (CCNA®) exam, applying what they have learnt to real-world scenarios.

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# Module: 5003861
# Computer Networks for Practical Engineers

## Module profile

**Exam number**
5003861

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Rolf Schillinger

**Lecturer(s)**
Prof. Bishnu Prasad Gautam

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This course provides students with practical knowledge and skills in computer networks, focusing on how networks are built, configured and operated by computer network engineers. The course begins at the physical layer with hands-on construction of LAN (Ethernet) cables, and then introduces fundamental concepts such as classful and classless IP addressing, switching and routing.
Students will learn static routing as a foundation, followed by dynamic routing protocols including RIP, OSPF and BGP through practical laboratory exercises. The course also introduces essential network security concepts, with particular attention to firewalls and basic network protection mechanisms required in real-world network environments.
In the final part of the course, students are introduced to next-generation networking paradigms, such as the Internet of Things (IoT), Software-Defined Networking (SDN) and quantum networks, providing insight into the future evolution of networks. As well as providing a broad foundation in computer networking for careers in IT and engineering, this course also supports self-study for the 200-301 Cisco Certified Network Associate (CCNA) exam by developing the relevant conceptual understanding and practical skills.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**

- Students understand the fundamentals of computer networking, including LAN construction, network components, and basic communication principles used in modern information systems.
- Students apply IP addressing, VLAN configuration and routing concepts to design and configure small- to medium-scale networks using both static and dynamic routing methods.
- Students analyse and compare dynamic routing protocols such as RIP, OSPF and BGP, and explain their operational principles, use cases and performance characteristics.
- Students design and implement practical network topologies by integrating routers, switches and end devices, and verify connectivity through hands-on configuration and testing.
- Students understand emerging and future network systems, including the Internet of Things (IoT), Software-Defined Networking (SDN) and quantum networks, and evaluate their potential impact on security, scalability and next-generation communication infrastructures.

**Literature**
Will be provided at the start of the module.

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# Module: 5003817
# Computer Vision: Artificial Intelligence Applied

## Module profile

**Exam number**
5003817

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Pascal Meißner

**Lecturer(s)**
Prof. Dr.-Ing. Pascal Meißner

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
None

**Content**
Have you ever wondered how self-service checkouts scan items, how self-driving cars recognise pedestrians, how computers detect skin cancer, and how 3D models of iconic places such as the Colosseum are created?

This module aims to answer these questions and many more by

- Providing an overview of the problems and approaches in computer vision, for applications as diverse as automation, robotics, medical imaging and photogrammetry.
- Introducing the fundamentals of neural networks, which are required for building artificial systems with human-level perception capabilities.

The module covers everything from selecting the appropriate equipment for visual inspection tasks to image classification using convolutional neural networks and image retrieval using ‘bag-of-visual-words’ models. The topics covered are:

01. Introduction – Terminology, history, state of the art, module logistics
02. Image Acquisition & Digitisation – Image sensors & representations, A/D conversion, Fourier transform
03. Image Enhancement – Point operations, contrast adjustment, smoothing filters
04. Feature Extraction – Edge detection, detection and description of local features
05. Segmentation and Morphology – Region growing, Hough transform, morphological operators
06. Camera Modelling – 3-D transformations, pinhole camera model, camera calibration
07. Stereo Vision – Epipolar geometry, correlation methods, triangulation
08. Classification – Classifier evaluation, generalisation, nearest-neighbour, decision trees
09. Ensemble Methods – Boosting and bagging, random forests, AdaBoost
10. Neural Networks – Multi-layer perceptron, gradient descent, backpropagation

11. Convolutional Neural Networks – Convolution and pooling layers, example architectures
12. Bag-of-Visual Words – K-means clustering, TF-IDF, histogram comparison

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Colloquium

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
By the end of the module, students should be able to:

- Select appropriate camera systems and convert image representations, as well as discuss the causes of aliasing and how to avoid it
- Implement and apply smoothing and morphological operators, edge detectors and segmentation techniques
- Distinguish between contrast adjustment methods and compare the various approaches to detecting and describing local features
- Determine and compute rigid-body transformations. Specify camera models and project image and scene points.
- Determine epipolar geometries and lines. Calculate and discuss different correlation methods
- Assess and implement the various techniques for visualising and cleaning data for training classifiers
- Apply feature engineering and selection to classification tasks
- Distinguish between the quantities in the bias-variance problem and apply this to classifiers
- Assess, implement and train neural networks, and discuss their application to computer vision tasks

This module will be taught in English and delivered both online and on campus. All sessions will be recorded. Colloquia may be conducted in English or German.

**Literature**

- Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 4th ed. Pearson, 978-0133356724, 2017
- Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library, Adrian Kaehler and Gary Bradski, O'Reilly Media, 978-1491937990, 2017
- Introduction to Machine Learning, Ethem Alpaydin, 4th ed. MIT Press, 978-0262043793, 2020

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# Module: 5003862
# Data Analytics

## Module profile

**Exam number**
5003862

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Tobias Aubele

**Lecturer(s)**
Dr. Jaani Väisänen

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
No coding required. Please install Altair AI Studio before the course; a student licence is available via https://web.altair.com/altair-student-edition.

**Content**
This course provides business students with a practical, no-coding introduction to data analytics using Altair AI Studio. You'll learn to build an end-to-end analytics workflow—from importing and preparing data to selecting variables, building models, evaluating performance, and interpreting results to inform business decisions.

- Course introduction, AI Studio workflow basics, and practical data preparation for modelling
- Regression

o Concept: what regression explains
o Hands-on workflow: build a regression model in AI Studio
o Validation and model quality: simple train/validation/test set incorporating key fit metrics

- Clustering

o Concept: grouping similar cases
o Hands-on workflow: prepare data and create clusters in AI Studio
o Validation and model quality: choosing a useful number of clusters for the business question

- Tree models

o Concept: classification and interpretable drivers
o Hands-on workflow: build and interpret a decision tree in AI Studio
o Validation and model quality: cross-validation and practical classification metrics

- Association analysis:

o Concept: co-occurrence and recommendations
o Hands-on workflow: create association rule sets in AI Studio
o Validation and model quality: support, confidence and lift

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of this course, students will be able to:
1. Construct end-to-end analytics workflows (Apply/Create): Independently design and execute complete data mining processes within Altair AI Studio—from data import and cleansing to model generation—without relying on programming code.
2. Analyse and select appropriate methodologies (Analyse): Diagnose specific business problems to determine the most suitable analytical technique (regression, clustering, decision trees or association analysis) based on the structure of the data and the desired business outcome.
3. Evaluate Model Performance and Robustness (Evaluate): Critically assess the quality of analytical models by interpreting quantitative validation metrics (such as $R^2$, lift, confidence and cross-validation scores) to distinguish between statistical noise and reliable patterns.
4. Synthesise Data into Business Strategy (Create): Translate technical model outputs into actionable business insights and formulate data-driven strategic recommendations for management.

**Literature**
will be specified during the lecture.

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# Module: 5003135
# Design Thinking & Innovation

## Module profile

**Exam number**
5003135

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Michael Müßig

**Lecturer(s)**
Lisa Straub

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BDGD, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
- An interest in creative yet challenging problem-solving approaches
- Entrepreneurial thinking
- A willingness to rigorously put one's own ideas to the test

**Content**
This course explains the fundamentals and background of innovation management, and design thinking in particular, illustrating these with clear examples. Above all, it is important to convey to participants that today's innovation processes place people at the centre and seek to reconcile customer needs with technical feasibility and economic viability. Students are provided with the basic tools to organise and carry out simple design thinking innovation processes independently. They must understand the basic elements underpinning an innovation or Design Thinking process and how these can be skilfully navigated through exercises. This provides a practical illustration of the differences between this approach and the traditional development process, the advantages of a customer-centred approach, and also the disadvantages associated with the Design Thinking (DT) approach.
The course is divided into two main modules:
1. A brief introduction to innovation management
Participants gain an insight into common innovation models and processes, as well as the background and basic concepts of innovation research.
2. Learning and applying Design Thinking
Design Thinking is based on an iterative, customer-centred and playful problem-solving process that enables participants to think beyond familiar solutions in order to realise or strive for ideas that have previously been overlooked, seem impossible, or may appear illogical or unattainable. During this course, participants will go through a Design Thinking process and, in the process, develop their own ideas into a project. The course is therefore designed to be interactive, which is why a high level of proactive participation is expected. In return, participants can look forward to a course full of creativity, interesting discussions and crazy ideas.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio, Presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
1. Students are familiar with the fundamental components of the Design Thinking process and can name them.
2. Students understand the role of Design Thinking in the context of other innovation models and processes and can contextualise them.
3. Students apply methods for effective problem definition to identify relevant challenges in the innovation process.
4. Students analyse the fundamentals of user research within the Design Thinking process and can explain its significance for solution development.
5. Students evaluate assumptions and hypotheses relevant to innovation in order to (de)construct them effectively.
6. Students organise and conduct brainstorming sessions to generate creative ideas.
7. Students develop prototyping processes, describe them conceptually and can explain their practical application.

**Literature**
Wobser, Gunther (2022): Agile Innovation Management: Overcoming Dilemmas, Mastering Ambidexterity and Achieving Long-Term Success through Innovation. Springer Gabler. 978-3662645147
Hasso Plattner Institute (A): What is Design Thinking. https://hpi-academy.de/en/design- thin- king/what-is-design-thinking.html.
Hasso Plattner Institute (B): The Six Steps in the Design Thinking Innovation Process. https://hpi.de/school-of-design-thinking/design-thinking/hintergrund/design-thinking- prozess.html.
IDEO: Design Thinking. https://designthinking.ideo.com/?page_id=1542.
d.School: An Introduction to Design Thinking. PROCESS GUIDE. Institute of Design at Stanford. https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAMP2010L.pdf.
Brown, Tim (2009): Change by Design. How Design Thinking Transforms Organisations and Inspires Motivation. 1st edition. Harper Business. 978-006176608-4.
Lewrick, Michael; Link, Patrick; Leifer, Larry (2017): The Design Thinking Playbook. Featuring traditional, current and future success factors. Verlag Franz Vahlen GmbH. 978-3039097050.
Uebernickel, Falk; Brenner, Walter; Pukall, Britta; Naef, Therese; Schindholzer, Bernhard (2015): Design Thinking. The Handbook. 1st edition. Frankfurter Allgemeine Buch. 978-3956010651.
Wobser, Gunther: Reinventing: What SMEs Can Learn from Silicon Valley. BESHU BOOKS. 978-3982195025

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# Module: 5003852
# Digital Sovereignty - Operational Concepts and Technologies

## Module profile

**Exam number**
5003852

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Tobias Fertig

**Lecturer(s)**
Prof. Dr. Michael Müßig,
Prof. Dr.-Ing. Tobias Fertig,
Andreas Schütz

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
None

**Content**
This module covers the fundamental concepts of digital sovereignty, with a focus on operational and technical implementation.
Following an introduction to key terms (e.g. dependence on platform providers, data sovereignty, vendor lock-in, open source, open standards), specific technical alternatives and tools are examined.

Topics covered include:
- Open-source software vs. proprietary solutions
- Full-stack open source (OS): in e-commerce, IT security, knowledge management, ERPs, etc.
- Digital sovereignty at all levels: from hardware to payment flows (PayPal, Apple Pay, Google Pay vs. the Digital Euro, GNU Taler, Wero, etc.)
- Cloud alternatives (self-hosting, European cloud providers)
- Open standards and interoperability
- Data protection, encryption and data storage
- Practical examples from public administration, education and business

In the project-based component, students work in teams on specific application scenarios (e.g. the digital infrastructure of a university, an SME or a local authority).
The aim is to design realistic technical concepts for improving digital sovereignty.
At the end of the semester, the results are presented and discussed at a transfer conference attended by the public and a jury.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**

- Students can identify key concepts, stakeholders and motivations relating to digital sovereignty.
- Students can explain how technical dependencies arise through software, cloud services and platforms.
- Students can select suitable open-source and open alternative solutions for specific application scenarios.
- Students can analyse existing digital infrastructures in terms of dependencies, risks and sovereignty deficits.
- Students can compare technical solutions in terms of cost, maintainability, security and sustainability.
- Students can design and present an operational concept to improve digital sovereignty for a defined scenario.

**Literature**

- https://link.springer.com/book/10.1007/978-3-031-69994-8
- https://direct.mit.edu/books/monograph/3504/The-StackOn-Software-and-Sovereignty
- https://link.springer.com/article/10.1007/s44206-024-00146-7

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# Module: 5003840
# Introduction to Project Management and Software Development based on SAP

## Module profile

**Exam number**
5003840

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Daniel Rösch

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Business Software, Programming 1

**Content**
In this FWPM, students learn – using a mobile order approval scenario – how modern SAP technologies relating to FIORI 3 and SAP UI5 are interconnected, structured and applied. An application based on FIORI 3 is developed using existing components, and the associated OData backend services are integrated. The course covers everything from planning and design through to the backend data model and user interface design. All tasks are carried out in small groups, which is intended to ensure that learning outcomes are retained in the long term.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Colloquium

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
This module provides students with fundamental knowledge and skills in the field of project management, particularly in the context of consultancy and the development of SAP FIORI applications.

- Students learn to plan, implement and manage SAP FIORI projects efficiently in order to meet the needs of businesses in the digital age.
- Students will review fundamental concepts, terminology and architectures of relational database systems.
- Students will understand the structure and functioning of SAP FIORI applications.
- Students will apply modelling techniques to create conceptual data models.
- Students analyse the technical and functional requirements of a specific task in order to select suitable technical solutions.
- Students independently create fully functional SAP FIORI applications using appropriate modelling and implementation tools.

**Literature**
Engelbrecht, M.: SAP FIORI – Implementation and Development, SAP PRESS Verlag, 2017

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# Module: 5003845
# Emotional and Persuasive Design in E-Commerce

## Module profile

**Exam number**
5003845

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Tobias Aubele

**Lecturer(s)**
Petteri Markkanen

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This module focuses on the design and development of an e-commerce website over the course of one intensive week, with a primary emphasis on emotional and persuasive design. The module combines theoretical foundations with hands-on, iterative practice, enabling students to apply design principles directly to real-world e-commerce contexts. The work is grounded in user experience design and extends to ethical design in relation to dark patterns, as well as growth hacking as a means of improving and optimising digital commerce solutions.
Throughout the week, students work in teams to design, build and iteratively refine an e-commerce website. All student teams are provided with access to a shared web hosting environment supplied by the course tutor, which is used throughout the week for building and testing the e-commerce sites. Theoretical concepts are continuously applied through practical implementation, user testing and reflection. Applying theoretical concepts in practice, combined with iterative testing and refinement of the students' e-commerce websites, provides valuable insights. This process helps students recognise and understand different user groups, learn how to engage them emotionally, and ethically apply emotional and persuasive strategies in an e-commerce context.

- Introduction to basic operations and UX principles.

Students set up the e-commerce website using WordPress and WooCommerce on the provided web hosting environment, define target groups, and create user personas.

- Emotional Design.

Students design and implement emotional design strategies tailored to their selected target groups and personas.

- Persuasive Design and Ethical Design.

Students carry out user testing, apply persuasive design strategies, and develop the next iteration of the website whilst identifying and avoiding dark patterns.

- Growth Hacking for e-commerce.

Students carry out further user testing, finalise the website, and develop a plan for growth and optimisation.

- Presentation and Reflection.

Students present their completed websites and key findings, followed by a reflection on the design and development process.
Mornings are devoted to theoretical sessions, whilst afternoons focus primarily on hands-on activities, such as building e-commerce sites, user testing and interviews.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon completion of the module, students will be able to:

- apply emotional and persuasive design principles to the design of e-commerce websites
- design and evaluate user experiences for different target groups
- recognise ethical challenges in persuasive design in relation to dark patterns
- iteratively improve an e-commerce website based on user testing and feedback
- reflect on the role of emotional and persuasive strategies in digital commerce

**Literature**
Norman, D. A. (2004) Emotional Design: Why We Love (or Hate) Everyday Things. New York, NY: Basic Books.
Yocco, V. S. (2016) Design for the Mind: Seven Psychological Principles of Persuasive Design. Brooklyn, NY: Manning Publications.
Ellis, S. and Brown, M. (2017) Hacking Growth: How Today's Fastest-Growing Companies Drive Breakout Success. New York: Currency.

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# Module: 5003846
# Ethical AI Hacking

## Module profile

**Exam number**
5003846

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Benjamin Weggenmann

**Lecturer(s)**
Paulius Baltrušaitis

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
Python, ML/AI basics

**Content**
This course provides a comprehensive understanding of Artificial Intelligence (AI) security,
with a focus on ethical hacking principles, attacks on ML models and data, and defence strategies and techniques.

Students will gain theoretical and practical knowledge of key threats such as evasion, model extraction, model inversion, data extraction, data poisoning and backdoor attacks. They will learn how to simulate attacks for testing purposes, which detection and protection techniques to employ, and how to apply them.

Machine learning models such as Linear Regression, Support Vector Regression, K-Nearest Neighbours, Logistic Regression, Support Vector Machines (SVM) and Decision Trees will be used.

Red and blue team scenarios will be used for practical exercises. Each student will take on a role on both sides. The course will utilise several different scenarios for various attacks and machine learning models.

Here is an example of a scenario for a red and blue team exercise focused on data poisoning and detection:
The company is developing a machine learning model to predict customer churn. The red team aims to reduce the accuracy of the logistic regression model by poisoning the data through label flipping. The blue team's objective is to detect and mitigate the attack.
Red team tasks: Analyse the dataset, develop the poisoning strategy, execute the attack, document the attack. The red team's success is measured by the extent to which they degrade the model's performance.
Blue team tasks: Establish a baseline (train a baseline model and evaluate its performance); implement detection mechanisms – using techniques such as outlier detection (e.g. Isolation Forest); mitigate the attack; document the defence. The Blue Team's success is measured by their ability to detect and mitigate the attack and restore the model's performance.
Both teams will be assessed on the clarity and thoroughness of their documentation and presentation of their findings to the whole group

of students, demonstrating and commenting on their Python code and explaining their strategies.
Tools for coding: Jupyter Notebook environment for Python (scikit-learn, pandas, numpy, matplotlib, seaborn), e.g. Google Colab.

By the end of the course, students will work in teams to formulate responsible AI security testing methodologies that meet ethical and legal standards. They will discuss and evaluate the ethical implications of AI vulnerabilities and develop a set of ethical guidelines for AI security and ethical hacking.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
1. Understand basic AI security concepts, ethical hacking principles, and key machine learning threats.
2. Identify and classify AI-specific attacks, including evasion, model extraction, and data poisoning.
3. Simulate red team (attacker) and blue team (defender) AI security scenarios.
4. Apply ethical hacking techniques to assess and exploit vulnerabilities in AI models.
5. Evaluate AI attack detection and protection strategies to improve security.
6. Investigate AI security breaches and analyse countermeasures.
7. Develop ethical guidelines for responsible AI security testing and vulnerability disclosure.

**Literature**
To be clarified during lessons

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# Module: 5003863
# International Digital Marketing

## Module profile

**Exam number**
5003863

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Christina Völkl-Wolf

**Lecturer(s)**
Sami Lanu

| | |
|---|---|
| **Applicability** | BIN, BWI, BDGD, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
None

**Content**
- Digital marketing strategies
- Digital marketing channels (owned, earned, paid)
- Search engine optimisation
- Segmentation of digital marketing target audiences
- Social media marketing (including TikTok)
- Digital marketing objectives, analytics and metrics

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon completion of the module/course, students will:
1. Remember & Understand:
- explain the role of marketing in e-commerce and in the digital society.
- describe the fundamental concepts of search engine optimisation (SEO).
- outline key digital marketing metrics and analytical tools.

2. Apply
- plan and implement digital marketing campaigns at an international level.
- carry out target audience segmentation using Meta and Google Ads tools.
- manage social media marketing activities.
- use digital analytics and tracking tools to monitor campaign performance.

3. Analyse
- analyse and select appropriate digital marketing channels (owned, earned and paid media) for different business objectives.
- evaluate campaign results based on relevant performance indicators.

4. Evaluate
- assess the effectiveness and efficiency of digital marketing strategies.
- compare and critically evaluate different digital marketing approaches and channels.

5. Create
- develop integrated digital marketing strategies for international markets.
- design data-driven optimisation plans for digital marketing campaigns.

**Literature**
Marketing 4.0 by Philip Kotler et al. (The lecturer will provide PDFs of the relevant sections of the book)
Digital Marketing Trends 2026 by Brandwatch (The lecturer will provide PDFs of the relevant sections of the book)
Latest Meta and Google Ads best practices (The lecturer will provide PDFs)

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# Module: 5003837
# Introduction to Artificial Intelligence

## Module profile

**Exam number**
5003837

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Andreas Lehrmann

**Lecturer(s)**
Prof. Dr. Andreas Lehrmann

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Basic knowledge of programming (Python) and mathematics (linear algebra, analysis).

**Content**
Over the past few years, artificial intelligence (AI) has profoundly changed the way we process information and make decisions, both in our personal and professional lives. A thorough understanding of the principles underlying AI is therefore a critical skill in many industries.

This course serves as a broad introduction to AI and its subfields. We will discuss — from the very beginning — the design, training and operation of an AI system. Drawing on intuitive concepts and visual insights, we will introduce a technical framework that enables us to describe the fundamental building blocks of an intelligently operating system (e.g., an autonomous robot). Such a system needs to:

- Organise task-dependent data and use this data to make predictions.
- Understand its environment by linking sensory information to physical location.
- Interact with its environment by planning routes and manipulating objects.

The course will be accompanied by small coding projects in Python that demonstrate the application of these concepts in a series of practical scenarios.

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In particular, the course covers the following topics:

[The State of AI] Historical developments, emerging trends and open questions
[Tools & Techniques] AI-assisted productivity and creativity
[The AI Pipeline] From hard-coded rules to learned decisions
[Data] Collection, representation and analysis of data
[Hello World] Algebraic, analytical and statistical foundations of AI
[Supervised Learning I] Data-driven models of reality: classification and regression
[Supervised Learning II] Data-driven models of reality: model complexity and regularisation

[Unsupervised Learning] Identifying patterns without annotations
[From Perception to Action I] Visual AI: understanding information in images
[From Perception to Action II] Visual AI: localising information in images
[From Perception to Action III] Embodied AI: manipulating environments
[From Perception to Action IV] Embodied AI: navigating environments
[Guest Lecture] Industrial applications of AI in the automotive industry
[AI & U] Working with and contributing to the future of AI

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**

- The students understand the structure of the AI landscape, including its various subfields and how they are interconnected.
- They can formulate industry tasks as learning problems (supervised, unsupervised, reinforcement) and select an appropriate AI framework for the type of data in question.
- They are familiar with the individual components of the selected AI framework — (1) data acquisition and representation; (2) model specification and optimisation; and (3) performance evaluation and analysis — and can set up and run this pipeline.
- The students understand the role of embodied AI and the challenges and solutions associated with it, such as perception, kinematics and navigation.

**Literature**
W. Ertel: Introduction to Artificial Intelligence, Springer, 2024.
C. Bishop: Pattern Recognition and Machine Learning, Springer, 2016.

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# Module: 5003069
# Mobile Applications

## Module profile

**Exam number**
5003069

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 50 hrs

*Self-study: 100 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Peter Braun

**Lecturer(s)**
Prof. Dr. Peter Braun

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
Good programming skills (e.g. from Programming 1 and 2, Web Programming 1 to 3) or equivalent.

**Recommended prerequisites for the participation in the module**
none

**Content**
This module introduces software development for mobile devices. The course will utilise the Android operating system and/or iOS. The development environment will be Flutter running on Android Studio or VS Code. Dart will be used as the programming language. No prior knowledge of Dart programming is required, but a good understanding of other languages (e.g. Java, Python or JavaScript) is essential.

Introduction to Dart Programming
- Brief overview of Flutter: history, advantages and architecture.
- Introduction to the Dart programming language.
- Setting up the development environment.

Introduction to Flutter – Flutter GUI development
- Understanding widgets and basic UI elements.
- Understanding stateful and stateless widgets.
- Layout widgets: Row, Column, Stack, etc.
- Basic interaction elements: buttons, sliders and switches.

Navigation and State Management
- Navigation patterns: push/pop navigation, named routes.
- Basics of state management: setState, Provider.
- Implementing forms and handling user input.

Working with External Data
- Fetching data from the internet (APIs).
- JSON serialisation and deserialisation.
- Firebase

Integrating Device APIs such as Location and Camera
- Introduction to Device APIs in Flutter.
- Implementing location services: retrieving and using GPS data.
- Accessing and using the camera: taking photographs and recording video.
- Handling permissions for location and camera.

Testing Advanced Features and Best Practices
- Animations and transitions.

- Using custom fonts and assets.
- Best practices in Flutter development.
- Testing Flutter apps

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**

- Students gain an understanding of the fundamentals of mobile application development using Flutter for Android and iOS, with a focus on professional programming practices.
- Students apply concepts of asynchronous programming and thread management to handle complex tasks in mobile applications efficiently.
- Students analyse architectural concepts for mobile solutions, including the division of responsibilities between client and server and communication protocols for mobile devices.
- Students design mobile user interfaces based on reusable software components, ensuring an intuitive and consistent user experience.
- Students implement mobile applications that integrate sensor data analysis and server communication, following best practice in mobile development.
- Students evaluate different mobile architecture approaches and technologies to select the most suitable solutions for specific application requirements.
- Students create a fully functional mobile application for Android or iOS, including publication and deployment.

**Literature**
Dieter Meiller: Modern App Development with Dart and Flutter 2: A comprehensive introduction to Flutter. De Gruyter Oldenbourg, 2021.

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# Module: 5003864
# Next-Generation Ethical Hacking and Cyber Forensics

## Module profile

**Exam number**
5003864

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Sebastian Biedermann

**Lecturer(s)**
Prof. Dr. Minal Moharir

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Basic knowledge of computer networks and operating systems.
Installation of Kali Linux on Oracle VirtualBox.

**Content**
1. Introduction to Ethical Hacking and Vulnerability Analysis
Fundamentals of key issues in the world of information security, including the basics of ethical hacking, the ethical hacking life cycle, various vulnerability assessment and penetration testing tools, and an overview of AI in offensive and defensive security
Hands-on: Shodan, Nmap, Nexpose, Netcraft, PrivateEye, Google advanced search operators, Harvester, Burp Suite, SIEM tools
2. Social Engineering and Session Hijacking
Social engineering concepts and techniques, including how to identify theft attempts, and the use of generative AI for phishing content and deepfakes
Web server attacks, including a comprehensive attack methodology used to audit vulnerabilities in web servers and web applications. Web application hacking methodology.
Hands-on:: Case study: Phishing attack; MiM attack: Kali Linux, BettrCap, SetTool Kit, GoFish; Hacking web servers and web applications: SQL injection attack, CSS attack, Splunk ML Toolkit
3. IoT and Cloud Hacking
IoT and cloud attacks, hacking methodology, hacking tools, IoT and cloud security techniques and tools
Hands-On:: IoT SCADA hacking using MODBUS. Automotive hacking, the role of AI in large-scale log analysis and anomaly detection in cloud/IoT telemetry, case study using Suricata
4. Introduction to Cyber Forensics: Principles of cyber forensics, chain of custody and evidence handling, introduction to types of digital evidence, importance of forensic image creation, introduction to machine-learning-supported triage of logs, files and network traces
Hands-On:: Create a forensic image using FTK Imager, validate image integrity with hash functions, Splunk SOAR
5. File System and Disk Forensics: Analysing File Systems: FAT, NTFS, EXT, data recovery techniques and deleted file recovery. Identifying hidden files and metadata
Network Forensics: Basics of network traffic analysis, identifying suspicious network activity, packet analysis and monitoring logs
Hands-on:: Create a forensic image using FTK Imager, validate image integrity using hash functions, analyse network packets using Wireshark, capture and analyse suspicious traffic for anomalies

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Develop a solid understanding of the concepts, techniques and tools used in ethical hacking and cyber forensics.
Identify, exploit and analyse vulnerabilities in systems, networks, IoT and cloud environments using both traditional and AI-assisted tools.
Apply forensic techniques and selected machine learning-based methods to investigate and document cyber incidents.
Execute different attack scenarios within an ethical framework.
Gain hands-on experience with industry-standard and AI-enhanced tools (e.g. Nmap, Wireshark, Metasploit, Autopsy and anomaly-

**Literature**
CEH with AI v13: Certified Ethical Hacker Study Guide by Ric Messier
"Digital Forensics with Open Source Tools" by Cory Altheide and Harlan Carvey
Securing Agentic AI: A Comprehensive Threat Model and Mitigation Framework for Generative AI Agents, https://arxiv.org/pdf/2504.19956

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# Module: 5003809
# Principles of Autonomous Drones

## Module profile

**Exam number**
5003809

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Deinzer

**Lecturer(s)**
Marcel Kyas

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
You will learn the fundamental methods for equipping autonomous aerial drones with perception, planning and decision-making capabilities. You will learn algorithmic approaches to robot perception, localisation and simultaneous localisation and mapping, as well as the control of non-linear systems, learning-based control and aerial drone motion planning. You will learn methodologies for reasoning under uncertainty.

On day one, you will learn to describe the basic control loop of an autonomous robot. You will explain the basics of drone locomotion and kinematics (how drones move). On day two, you will learn to identify the purpose of sensors on a drone. You will explain the structure and applications of Bayesian filters. On day three, you will learn to implement a simple localisation system. On day four, you will learn to explain behaviour trees as a formalism for describing drone behaviour. You will learn to define the principles of planning algorithms (Dijkstra's Algorithm, A* Search, D* Search). You will apply reinforcement learning to solve drone planning problems.

You will design a simulation in Robot Operating System 2 (ROS2) for demonstrations and practical activities.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Colloquium

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
1. Students are familiar with the fundamental principles of motion control as applied to autonomous aerial drones.
2. Students understand the basic concepts of perception, distinguishing between traditional approaches and deep learning methods for robot perception.
3. Students can explain the principles of localisation and Simultaneous Localisation and Mapping (SLAM), including their importance for autonomous navigation.
4. Students analyse navigation algorithms, focusing on the planning and decision-making processes necessary for effective drone operation.
5. Students apply algorithmic approaches to robot perception, localisation and planning in practical scenarios.
6. Students implement learning-based control techniques for aerial drones to enhance their motion planning capabilities.
7. Students utilise the Robot Operating System (ROS) in demonstrations and hands-on activities, reinforcing the theoretical concepts covered in the course.

**Literature**
Roland Siegwart, Illah Reza Nourbakhsh, and Davide Scaramuzza. *Introduction to Autonomous Mobile Robots*, second edition. 2011, The MIT Press
Sebastian Thrun, Wolfram Burgard, and Dieter Fox. *Probabilistic Robotics*. 2005, The MIT Press

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# Module: 5002910
# Project Work

## Module profile

**Exam number**
5002910

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
10.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 240 hrs*

*Total: 300 hrs*

**Teaching format**
Project

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Prof. Dr. Frank Hennermann,
Prof. Dr. Karsten Huffstadt,
Prof. Dr. Michael Müßig,
Prof. Dr. Gabriele Saueressig,
Prof. Dr. Kristin Weber,
Prof. Dr. Eva Wedlich,
Prof. Dr. Frank-Michael Schleif,
Prof. Dr. habil. Nicholas Müller

## Applicability

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
100 ECTS credits

**Recommended prerequisites for the participation in the module**
none

**Content**
Project work is usually carried out as a team (at least three students). It involves either end-to-end software development in accordance with the principles of software engineering, or another task from the field of IT (e.g. software comparison, software implementation, process modelling). Each project is supervised by a professor from the Faculty of Computer Science and Business Informatics. As part of the project work, students practise the techniques and methods of business informatics they have learnt in a professional context (teamwork, project organisation, practical tasks).
In the standard degree programme, the topics for the practical examples used in the assessment are provided by the lecturer or agreed with them. In the dual study programme, a task from a real-world business context is undertaken in consultation with the lecturer.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
error

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
Students are able to methodically tackle and solve comprehensive, practical problems in the field of business informatics.
Students select appropriate business informatics methods depending on the situation and apply them effectively.
Students are able to independently develop and implement suitable solution strategies as part of a team.
They understand how team processes work and how they can contribute their own personality to them.
They are able to document and present project procedures and outcomes in a way that is tailored to the target audience.

**Literature**
depending on the specific project work

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# Module: 5003865
# Quantum Computing

## Module profile

**Exam number**
5003865

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank-Michael Schleif

**Lecturer(s)**
Dr. Divyarani Mandya Shivakumar

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Basic Linear Algebra and Python Programming

**Content**
This course provides a comprehensive introduction to the principles, mathematical foundations, hardware concepts and programming tools of quantum computing. Students will explore qubits, superposition, entanglement, quantum gates, algorithms, noise models, error correction and real-world applications. Hands-on sessions using Qiskit enable learners to construct and simulate quantum circuits and run programmes on IBM Quantum devices.

1. Foundations of Quantum Computing
Classical versus quantum computation, qubits and quantum states, superposition and entanglement, Dirac notation (bras and kets), Bloch sphere representation, quantum measurement and collapse, physical implementations of qubits: superconducting, ion traps, photonic systems.
2. Quantum Gates and Quantum Circuits
Single-qubit gates: Pauli-X, Y, Z, Hadamard (H), phase, S, T; multi-qubit gates: CNOT, swap, controlled phase; building quantum circuits; principles of reversible computing; quantum circuit simulation tools; IBM Qiskit basics; circuit construction and visualisation; noise, error sources and decoherence.
3. Quantum Algorithms
Quantum parallelism, Deutsch–Jozsa algorithm, Grover's search algorithm, Shor's factoring algorithm, Quantum Fourier Transform (QFT), Phase estimation, Variational Quantum Algorithms (VQA): VQE, QAOA
4. Quantum Hardware, Noise & Error Correction
NISQ (Noisy Intermediate-Scale Quantum) era systems, Quantum noise models: Bit flip, phase flip, depolarising noise, basics of quantum error correction: Shor code, Steane code, surface code (overview), fault-tolerant quantum computation, claims of quantum supremacy (Google, IBM).
5. Applications, Future Trends & Quantum Programming
Quantum cryptography (BB84, QKD), Post-Quantum Cryptography (PQC), basics of Quantum Machine Learning (QML), Quantum optimisation (QAOA use cases), Quantum simulation in chemistry & physics Hands-on Qiskit programming: Creating circuits, running them on simulators, running them on IBM Quantum systems.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of the course, students will be able to
1. Explain the fundamental concepts of qubits, superposition, entanglement and quantum measurement.
2. Construct and simulate quantum circuits using quantum gates and operators.
3. Analyse how major quantum algorithms work and identify their computational advantages.
4. Understand hardware constraints, quantum noise and basic quantum error correction techniques.
5. Implement quantum programmes using Qiskit and evaluate applications of quantum computing across various fields.

**Literature**
Textbooks:
1. Nielsen, M., & Chuang, I. *Quantum Computation and Quantum Information*, Cambridge University Press, 2010.
2. Yanofsky, N., & Mannucci, M. *Quantum Computing for Computer Scientists*, Cambridge University Press, 2008.
References:
1. IBM Quantum Documentation – https://quantum-computing.ibm.com
2. Qiskit Textbook – https://qiskit.org/learn
3. Preskill, J. Quantum Computing in the NISQ Era.
4. Arun P. Quantum Computing: An Applied Approach, Springer
Online resources (e-books, notes, PowerPoint presentations, video lectures, etc.):
1. Qiskit Tutorials: https://qiskit.org/tutorials
2. Quantum Algorithms Zoo: https://quantumalgorithmzoo.org
3. MIT OCW – Quantum Computation
4. IBM Quantum Lab (free cloud access).

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# Module: 5003067
# Requirements Engineering

## Module profile

**Exam number**
5003067

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Isabel John

**Lecturer(s)**
Prof. Dr. Isabel John,
Dr. Anne Heß,
Dr.-Ing. Benedikt Kämpgen

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Software Engineering / Software Development

**Content**
This module focuses on the crucial initial phase of the software development lifecycle, during which the system's requirements and constraints are gathered, analysed and documented. Similarly, machine learning (ML) system development projects benefit from RE. This module therefore covers requirements engineering techniques for both traditional systems and ML systems.

Fundamentals of Requirements Engineering
Task-Oriented and Goal-Oriented RE
Elicitation Techniques
Analysis Techniques
Specification and Modelling Techniques
Validation Techniques
RE in User Experience Engineering
RE Skills
Case Studies and Applications of Requirements Engineering
Requirements Engineering for Machine Learning Systems
Requirements Engineering in the Age of ChatGPT and Generative Artificial Intelligence

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**
Students recall fundamental RE models, methods and their relevance to the software development process.
Students understand the importance of requirements engineering, including stakeholder analysis, in a variety of project contexts, including international and AI-driven projects.
Students apply requirements elicitation techniques and modelling methods, such as UML, use cases, user stories and non-functional requirements, to real-world scenarios.
Students analyse requirements through negotiation, prioritisation and validation against quality criteria to ensure completeness and clarity.
Students evaluate different RE approaches and adapt techniques suited to specific domains such as machine learning and generative AI systems.
Students create comprehensive requirements specifications and models that address the needs of complex, modern software systems, including AI applications.
Students are able to adapt requirements engineering techniques for generative artificial intelligence-based systems.

**Literature**
Cockburn, *Writing Effective Use Cases*, Addison Wesley, 2016
Hull, *Requirements Engineering*, Springer Verlag, 2019
Berenbach, *Software & Systems Requirements Engineering: In Practice*, McGraw Hill, 2017
Chris Rupp & the SOPHISTs, Requirements Engineering (in German), Hanser, 2022
Huyen, Chip. Designing Machine Learning Systems. O'Reilly Media, Inc., 2022.

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# Module: 5003857
# Seminar Smart Systems

## Module profile

**Exam number**
5003857

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Arndt Balzer

**Lecturer(s)**
Prof. Dr. Arndt Balzer

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Courses in the field of computer engineering

**Content**
Content: In this specialisation module, students work independently on topics relating to smart systems. They develop and present solutions (involving both hardware and software).
Topics from previous years (selection): AI-based checkout, Braille reader, inverse pendulum, Kalman filtering, pathfinding with Turtlebot, quadcopter, radar + lidar, ROS (Robot Operating System), SDR (Software-Defined Radio), SLAM (mapping, localisation, navigation), supervised learning, reinforcement learning, rock-paper-scissors on Pepper, Wi-Fi indoor localisation, ...
The seminar operates under a regularly updated overarching theme, within which individual topics are assigned. The topics are finalised at the start of the seminar and are based on current developments. Areas of interest always include actuators and sensors, low-performance systems right through to smartphones, their programming and the evaluation of prototypical implementations.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Multimedia presentation, Colloquium

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Learning objectives: By engaging with a selected topic, students will develop their ability to tackle challenging subjects.

- Students will acquire fundamental mathematical and technical knowledge
- They will use this to derive the specialist knowledge required for their specific topic or field of application
- They apply this knowledge using the methods they have learnt and gain further confidence in their application

The findings are documented and the results are presented at the end of the seminar

- Students develop the ability to document and present results clearly.
- Students apply methods of scientific work, including (literature) research.
- Students develop their ability to independently expand their existing knowledge and to quickly familiarise themselves with topics being studied by others (fellow students)

**Literature**

- To be announced in due course.

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# Module: 5003854
# Smart Agriculture

## Module profile

**Exam number**
5003854

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Peter Braun

**Lecturer(s)**
Prof. Dr. Peter Braun,
Prof. Dr. Isabel John

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
None

**Content**
The module addresses typical challenges in smart agriculture using a specific example: the systematic collection of data in the field using drones, the structured processing and analysis of image data, and the derivation of transparent key performance indicators and maps as a basis for an initial assessment. Building on this, methods for image-based detection and quantification of anomalies are developed and integrated into a simple data management system with visualisation. A further focus is on the validation of image-based findings using independent measurement values, as well as on the statistical testing and interpretation of relationships using correlations. Implementation takes the form of prototypes, comprising software artefacts and presentations of results.

The module is run in cooperation with our partner institution, Suwa University of Technology in Japan, and is supported by teaching contributions from professors at the partner university. An important part of the module is a field trip to Suwa University, during which the prototype results are further developed, validated and jointly presented together with Japanese students. Intercultural content covers etiquette, communication styles in emails and video conferences, joint laboratory work, projects and presentations, as well as conduct and everyday customs whilst in Japan.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**

- Students describe key data sources and outputs (drone images/ logs, AI results, measurement values) and organise them into a consistent data flow.
- Students implement a traceable data pipeline in Python, including simple quality controls and reproducible exports (e.g. GeoTIFF/PNG, reports).
- A group of students calculates ExG/VARI/NDVI and critically interprets index maps under field conditions (changes in light, shade, missing bands).
- A group of students explains fundamental AI tasks (classification, detection, segmentation) and assesses their limitations due to domain shift and uncertainty in the field.
- A group of students correlates physiological measurements (Fv/Fm, chlorophyll index) with image/AI metrics (Pearson/Spearman) and derives an evidence-based assessment from this.
- Students explain basic etiquette and manners in the Japanese higher education environment and use this to determine appropriate behaviour in meetings and on site.
- Students draft professional emails and prepare for video conferences with Japanese contacts in a structured manner.
- Students carry out their project using appropriate project management methods and take intercultural project management aspects into account during the field trip and when interacting with Japanese students.

**Literature**
This will be announced later in the seminar.

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# Module: 5003810
# Software Testing

## Module profile

**Exam number**
5003810

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Peter Braun

**Lecturer(s)**
Pascal Moll

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BISD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
Programming I, or Back-end Programming, or Programming in Python, or Fundamentals of Programming; Object-Oriented Programming in Java
Participants will be provided with a virtual machine, which should be tested to ensure it is working properly before the course begins.

**Content**
This module covers various types of testing and their application in software development. It teaches the SOLID principles and the four-layer concept for test architectures. It also covers automated testing of user interfaces and APIs, as well as the use of mocking. Another key focus is Behaviour-Driven Development using Cucumber. Exploratory testing and the integration of automated tests into a DevOps life cycle are also covered. The module includes practical content, for which a virtual machine is provided. This requires the installation of VirtualBox.

- Fundamentals of testing (test coverage, test paths, black-box, white-box, grey-box testing, functional and non-functional tests, test pyramid)
- Test automation (objectives, success factors, differences between various types, the JUnit test framework, annotations, assertions, exception testing, parameterisation, test types, record-replay, scripted testing, keyword-driven testing)
- Test architecture (SOLID principles, 4-layer concept, test modelling layer, test definition, test execution, test adaptation, interfaces, design and development, key design patterns for testing)
- Testing graphical user interfaces (Introduction to Selenium, drivers, PageObject pattern, identifiers, waits, cookies)
- Mocking (Wiremock)
- Behaviour-Driven Development (Feature Files & Step Files, Cucumber & Gherkin, Parameters, Data Tables, Scenario Outlines and Background, Runner Classes)
- Exploratory Testing (Methods and Techniques)
- Build servers (Jenkins basics & DevOps basics, gPipelines, the DevOps process from a testing perspective)

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
None

**Learning outcomes**

- Students define test objectives for a piece of software.
- Students analyse test objectives and define appropriate test types.
- Students translate test types into automated tests.
- Students decide on the use of design patterns in testing and apply design patterns.
- Students explain Behaviour-Driven Development.
- Students set up and configure a build server for testing.

**Literature**

- Essentials of Software Testing* by Ralf Bierig, Stephen Brown, Edgar Galván and Joe Timoney, 2021, Cambridge University Press

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# Module: 5003858
# Smart Systems

## Module profile

**Exam number**
5003858

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Arndt Balzer

**Lecturer(s)**
Prof. Dr. Arndt Balzer

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Programming I + II, Fundamentals of Computer Engineering, Computer Architecture, Operating Systems, Algorithms & Data Structures

**Content**
- Introduction to C for programmers
- Specific aspects of microcontroller programming (ESP32, Espressif's 32-bit microcontroller family)
- Memory model, interrupt concept, …
- Hardware architecture and programming of common interfaces for communication and control of peripherals such as U(S)ART, SPI (four-wire), I²C (two-wire), OneWire, CAN
- Programming of peripheral devices such as digital sensors: IMU (10-axis), digital thermometers, ultrasonic sensors and actuators: displays, servos, loudspeakers, etc.
- Programming wireless interfaces (RF) such as Bluetooth and Wi-Fi to control applications such as servos, etc., using smartphones
- Implementation of small AI models (image recognition using a USB camera)
- Introduction to a modern, application-based development environment: ESP-IDF (Espressif IoT Development Framework)

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Colloquium, Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students will be able to

- explain the specific programming of controllers and their interfaces,
- to evaluate interfaces that have evolved over time,
- to use a software development environment that makes efficient use of innovative and application-optimised peripheral functions,
- to develop low-level software in the C programming language for various use cases.

**Literature**

- Kernighan, Ritchie: The C Programming Language, 2nd Edition (ANSI)
- Udo Brandes: The ESP32 Microcontroller – The Comprehensive Handbook
- Dausmann, et al.: C as a First Programming Language, Vieweg, 2011, ebook
- Wolf: C from A to Z, Galileo Computing, openbook

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# Module: 5011279
# Transfer colloquium

## Module profile

**Exam number**
5011279

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Prof. Dr. Frank Hennermann

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
For dual-study students on the BWI degree programme only

**Recommended prerequisites for the participation in the module**
none

**Content**
The Transfer Colloquium is designed to facilitate discussion amongst students on the dual study programme and replaces one of the FWPM sessions. Students on the standard version of the programme do not take part in this session. The session takes place across the third to seventh semesters, with the exception of the work placement semester. Under the guidance of a lecturer, dual-study students discuss the following topics:

- Introduction and overview: Presentation of the Transfer Colloquium and its objectives; explanation of the importance of the exchange of experiences between the university and the company for dual-study students.
- Reflection on practical experience: In-depth reflection on the knowledge and skills acquired during studies and in practical placements, as well as their application in day-to-day business operations.
- Exchange of experiences: Moderated discussions on challenges and solutions relating to balancing university studies with practical work in the company.
- Best-practice examples: Presentation and discussion of successful projects and practices from the company that have been implemented by students during their studies and in practical work.
- Problem-solving strategies: Development and presentation of approaches to solving typical problems that may arise in a dual study programme, including time management and prioritisation.
- Application of theoretical knowledge: Deepening the understanding of how theoretical knowledge from university modules can be applied in practice within the company.
- IT security in the company: An introduction to the importance and implementation of IT security measures in practice, based on theoretical principles and practical applications.
- Project documentation and presentation: Training in the preparation and presentation of project documentation to present the work carried out within the company in a structured manner.
- Feedback and continuous improvement: Systematic collection and analysis of feedback from companies and the university to ensure the continuous improvement of the dual study programme.
- Professional development and career planning: Discussion of career paths and development opportunities for dual-study students,

based on the skills acquired during their studies and in practical work.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
Compulsory attendance

**Learning outcomes**

- Students systematically reflect on their practical experiences in order to draw conclusions for their professional development.
- Students develop strategies for resolving problems that arise when balancing their studies with practical work.
- Students apply the theoretical knowledge they have acquired in a practical context within the organisation in order to optimise the transfer of knowledge between the university and the workplace.
- Students communicate their practical experiences clearly and in a structured manner and present their findings effectively.
- Students assess the importance of IT security in a business context and implement appropriate measures in their day-to-day work.
- Students produce professional project documentation to ensure their work is transparent and traceable.
- Students use feedback constructively to continuously improve their working methods and the collaboration between the university and the company.

**Literature**
To be announced during the seminar.

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# Module: 100002
# Usability for Engineers and Computer Scientists

## Module profile

**Exam number**
100002

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 0 hrs

*Self-study: 150 hrs*

*Total: 150 hrs*

**Teaching format**
Lecture

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Isabel John

**Lecturer(s)**

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
This is a programme offered by the Virtual University of Bavaria.
Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=19832,83,816,1

**Recommended prerequisites for the participation in the module**
none

**Content**
This is a programme offered by the Virtual University of Bavaria.
Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=19832,83,816,1
In our highly technologised and interconnected world, the usability of products, services and interactive systems is becoming an increasingly important factor for users on the one hand, and a competitive advantage for manufacturers on the other. With comparable functionality, many products are being offered at ever lower prices in the global marketplace. Users have a choice and will opt for the benefits of a product that has been tested and optimised for usability and user experience. By applying usability engineering methods, manufacturers can meet these requirements and develop unique selling points for their products. Usability and user experience objectives should therefore be taken into account as early as possible in the development process and implemented using appropriate methods, not least to avoid costly development failures and to increase the benefits for customers. Prospective engineers and computer scientists must be able to recognise this issue and know in which phases of product development suitable methods are applied.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
This is a course offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=19832,83,816,1
Identifying the content of the analysis phase in usability engineering.

- Independently applying analysis methods and techniques from usability engineering
- Identifying, on a case-by-case basis, relevant sections of the DIN/ISO 9241 series of standards
- Describing and applying terms (usability) and principles (dialogue design)
- Describing and applying a process for designing usable interactive systems
- Describing the key aspects of cognitive psychology and occupational psychology
- Identifying and naming criteria for evaluating colour schemes in order to identify and name associated usability problems
- Describing fundamental aspects of contrast and its use in design
- Recognising in which development phases Gestalt principles must be observed and how these simple principles help to identify usability problems
- Applying Gestalt principles in a targeted manner within the context of usability evaluations
- Describing the typical approach in interface and interaction design.
- Identify different types of prototypes and describe their function in usability engineering
- Describe and apply usability metrics from the areas of ‘usability performance metrics’ and ‘usability issue-based metrics’.

**Literature**
see course

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# Module: 5005203
# Business Intelligence

## Module profile

**Exam number**
5005203

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank-Michael Schleif

**Lecturer(s)**
Prof. Dr. Frank-Michael Schleif

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
120 ECTS credits, course 5002530

**Recommended prerequisites for the participation in the module**
Databases, Programming I, maths knowledge from the foundation year

**Content**
The module is largely replaced by the VHB course ‘Business Intelligence and Reporting’
. To complement the VHB course, 2–3 dedicated sessions on BI will be offered
(drawn from the scope of the original BI module; see the description below)
– as well as an enrichment lecture/workshop, provisionally scheduled for June 2026

- -

The module aims, via a blended learning approach
using Moodle as the platform, to teach new methods from the fields of data science and
business intelligence for data collection, pre-processing,
predictive modelling and data visualisation.

The knowledge imparted will be applied and tested through demonstration projects.
Various learning methods and knowledge-transfer techniques will be utilised,
which take particular account of participants’ individual prior knowledge.

In addition to following the main course content, the course allows participants
to explore individual topics in greater depth or to fill any gaps in their knowledge
through more intensive work on supplementary material provided.

Module contents:
- Refresher on essential mathematical concepts
(statistical measures, matrix algebra, eigenvalue analysis)
- Introduction to data analysis tools (focus: KNIME)
- Opportunities, limitations and risks of data analysis / data science
- Mathematical foundations of data science
- Data pre-processing and cleaning
- Models, modelling, evaluation methods

- Unsupervised and supervised learning
- Data visualisation
- Enrichment topics (provisional)
- External industry contribution on data analysis
- Deep learning and neural networks
- Further topics based on participants' interests and prior knowledge

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- analyse data analysis problems within a business context and develop a conceptual solution
- model and implement data analysis projects in KNIME
- Participants can compare and evaluate alternative solutions

and understand the specific characteristics of the respective methods

- Participants are able to present the results of a data analysis
- Students are aware of the limitations and possibilities of data analysis

and have developed a self-critical understanding

**Literature**

- *The Data Science Design Manual*, Steven Skiena, Springer International Publishing, 2017
- *The Elements of Statistical Learning*, Trevor Hastie, Springer, 2009
- Python Data Science Handbook, Jake VanderPlas, O'Reilly Media, 2016
- Deep Learning, I. Goodfellow, The MIT Press, 2016
- Further reading as required

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# Module: 5007211
# Mobile and Ubiquitous Concepts and Development

## Module profile

**Exam number**
5007211

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Karsten Huffstadt

**Lecturer(s)**
Prof. Dr. Karsten Huffstadt

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
120 ECTS credits, course 5002530 or 5102530 or 6102410

**Recommended prerequisites for the participation in the module**
none

**Content**
The 'Mobile and Ubiquitous Concepts and Development' module offers students the opportunity to specialise either in technical or conceptual aspects. The focus is on the development of a digital product or service for mobile or ubiquitous usage contexts – either in the form of a functional prototype or a strategically sound marketing concept.

Students focusing on technology and development create a fully functional application programmed entirely by themselves (e.g. using Flutter, web technologies or native tools), whilst concept-oriented participants develop a comprehensive business, marketing or interaction concept – including target group analysis, value proposition, customer journey and monetisation strategy. Both approaches are based on real-world challenges and conclude with a presentation of the solution. In this way, the module fosters both application-oriented programming skills and strategic, creative conceptual abilities.

Specific content includes:
- Areas of application for mobile and ubiquitous systems
- Tools for rapid app/web development (e.g. Flutter, Firebase, web technologies)
- Conceptualisation and design of context-sensitive mobile services
- Customer experience and interaction strategy
- Market and user analysis, value proposition design
- Monetisation and scaling (e.g. freemium, subscription, platform models)
- Agile methods and iterative project development
- Testing, user feedback and optimisation
- Presentation and pitching of digital products

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Upon completion of the module, students will be able to:

- identify technologies, business models and success factors in the field of mobile and ubiquitous applications (to remember)
- explain the requirements and specific characteristics of mobility, context sensitivity and user needs in digital systems (to understand)
- either utilise technical development tools (e.g. Flutter, web stacks), or apply methods for ideation, market analysis and business modelling (to apply)
- analyse usage contexts and problem statements in order to derive functional or strategic solutions (to analyse)
- critically evaluate their own and others' concepts or applications in terms of utility, feasibility, innovative content and market viability (to evaluate)
- either programme a functioning application or create a viable, structured marketing or application concept (to create)

**Literature**
Ries, E. (2011). The Lean Startup. Crown Publishing
Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation. Wiley
Rogers, Y., Sharp, H., & Preece, J. (2023). Interaction Design. Wiley
Cook, D. (2021). Flutter for Beginners. Packt Publishing
Norman, D. A. (2013). The Design of Everyday Things. Basic Books

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# Module: 5004201
# Business Software Processes

## Module profile

**Exam number**
5004201

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Prof. Dr. Frank Hennermann

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
Course: Practical module; 120 ECTS credits

**Recommended prerequisites for the participation in the module**
Business software, logistics, accounting, business technologies

**Content**
SAP S/4HANA Enterprise Management
SAP Fiori UX
SAP S/4HANA Basics
Financial Accounting
Management Accounting
Human Capital Management
Purchase to Pay
Warehouse Management
Plan to Produce
Order to Cash
Project System
Enterprise Asset Management

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students are familiar with the organisational structures of an ERP system and can explain how they are used.
Students are familiar with the key applications of an ERP system, can explain how they are used, and are able to describe the key integration aspects of the applications.
Students are familiar with the key basic functions of an ERP system and are able to apply them.
Students are familiar with the key master data of an ERP system and are able to apply it within an ERP system.
Students are familiar with the key business transactions of a company and are able to apply them within an ERP system.
Students can analyse user interfaces and assess their strengths and weaknesses.
Students are familiar with various database concepts and can analyse and evaluate them.

**Literature**
Sales with SAP S/4HANA by Alena Bauer, Fatjon Hoxha, Jochen Scheibler, 2018, SAP PRESS.
Liebstückel, Karl: Practical Handbook on Maintenance with SAP, 6th edition, Sappress-Verlag 2023.
SAP S/4HANA Finance by Janet Salmon, Thomas Kunze, Daniela Reinelt, Petra Kuhn, Florian Roll, Christian Giera, 2nd edition 2018, SAP PRESS.
Logistics with SAP S/4HANA by Jasmin Burgdorf, Mario Destradi, Martin Kiss, Maik Schubert, 2nd edition 2019, SAP PRESS.
Materials Management with SAP S/4HANA: Business Processes and Configuration, by Jawad Akhtar and Martin Murray, 2nd edition, SAP PRESS 2020.
Alexander Wolf, Christoph Sting: Production Planning and Control with SAP S/4HANA, Sappress-Verlag 2021.
Mario Franz: Project Management with SAP Project System, SAP PRESS, 5th edition, 2017.
Justin Ashlock: Sourcing and Procurement with SAP S/4HANA, SAPPRESS, 2nd edition, 2020.
Practical Handbook on SAP Human Resources, Anja Marxsen, Christian Buckowitz, Nathalie Cuello, Sven-Olaf Möller, SAP PRESS, 6th, updated and expanded edition, 2016
Jörg Lange, Frank-Peter Bauer, Christoph Persich, Tim Dalm, Gunther Sanchez, Tobias Adler, Jennifer Massucci, Denis Vonscheidt: Warehouse Management with SAP EWM, SAPPRESS, 4th edition, 2019.

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# Module: 5004100
# Seminar Business Software

## Module profile

**Exam number**
5004100

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 40 hrs

*Self-study: 110 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Christian Fink

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
Course: Practical module; 120 ECTS credits

**Recommended prerequisites for the participation in the module**
Business Software

**Content**
At the start of the seminar, topics relating to S/4HANA Private Cloud, S/4HANA Public Cloud and the SAP Business Technology Platform (BTP) will be presented and allocated. Participants will prepare a paper on their respective topic and design practice exercises
for all seminar participants. The solution developed will be presented during the seminar and discussed at length. Participants will have ample opportunity to practise the topic presented using the exercises designed by the group members.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Term paper, Presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students recall fundamental concepts, terminology and architectures of modern business software.
Students understand the structure and functioning of modern business software.
Students analyse the functional and technical requirements of a specific business software task.
Students are able to familiarise themselves independently with a new topic and plan the aspects to be presented.
Students are familiar with the organisational structures relating to their topic and are able to explain them.
Students are familiar with the master data relating to their topic and are able to apply it.
Students are familiar with the business processes relating to their topic and are able to apply them.

**Literature**
It is part and parcel of a seminar that participants are expected to find the literature required for their seminar paper themselves.

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# Module: 5005100
# Seminar Business Technologies

## Module profile

**Exam number**
5005100

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 40 hrs

*Self-study: 110 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Gabriele Saueressig

**Lecturer(s)**
Prof. Dr. Gabriele Saueressig,
Prof. Dr. Frank-Michael Schleif

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
120 ECTS credits, course 5002530

**Recommended prerequisites for the participation in the module**
none

**Content**
Seminar content:

- Various current topics from the key areas of Business Intelligence and Business Process Management will be covered
- Academic work, including literature research and methodological guidance on writing a seminar paper
- A seminar paper on the assigned topic is to be written and presented by the student or in pairs

The seminar papers should each provide an overview of selected concepts, software architectures, processes, methods or technologies and, where applicable, their implementation in software systems.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Term paper, Multimedia presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- understand and apply specific issues, methods and techniques in the fields of business intelligence and business process management
- to research a given specialist topic independently, analyse it accurately from a technical perspective, and present it in an academic manner both in writing and orally
- to analyse the findings of their own topic academically and present them in a manner appropriate to the audience

Subject-specific competences:

- Students broaden and deepen their knowledge of specific issues within the fields of 'Business Intelligence' (BI) and 'Business Process Management' (BPM).
- Based on a specific topic, students learn to describe the underlying issues and identify potential solutions using modern technologies in the fields of BI and BPM.
- By working on their own topic and engaging with the other topics covered in the seminar, students become familiar with and learn to evaluate current issues
- To solve subject-specific problems, students learn to select appropriate methods and apply them to a specific example scenario.
- Students learn to independently acquire and apply the specialist knowledge required to develop their seminar topic.
- Students acquire the skills to identify significant technical developments and put these into practice using the seminar topics from BI and BPM as examples
- Students analyse various practical tasks, familiarise themselves with application examples and the appropriate IT support for these

Interdisciplinary skills:

- Students learn and apply in practice the skills required to present and document academic findings clearly (preparation of the seminar paper and presentation of the results in the seminar)
- Through critical discourse within the seminar, students learn to discuss their own and other seminar topics
- Students become familiar with and learn to apply key concepts of academic work (literature research, rules for typesetting, citation, the structure of an academic paper, etc.)
- New and advanced skills in the effective use of typesetting systems, literature research and presentation tools are acquired

Key competences:

- Students learn to familiarise themselves in depth with a subject-specific but unfamiliar topic and to analyse its content
- Students deepen their competence in presenting subject-specific, new content and are able to document, communicate and apply the material they have developed in exemplary or prototypical ways

**Literature**

The reading list relevant to each specific seminar topic will be announced during the seminar.

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# Module: 5007110
# Seminar Mobile and Ubiquitous Solutions

## Module profile

**Exam number**
5007110

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Karsten Huffstadt

**Lecturer(s)**
Prof. Dr. Karsten Huffstadt,
Prof. Dr. Isabel John

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 6. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
120 ECTS credits, course 5X02530

**Recommended prerequisites for the participation in the module**
none

**Content**
This module combines the application-oriented perspective of mobile and ubiquitous systems with the requirements of academic work. It focuses on exploring current issues, concepts and technologies in the fields of mobile computing, context awareness, smart environments and human-centred design.

Students develop an initial academic research question on a topic of their own choosing or one suggested by the module, and address this in a theory-driven and structured manner within the framework of an academic paper. In doing so, they engage with specialist literature, current research trends and methodological approaches. In addition to writing the paper, the module also focuses on academic presentation – including a discussion and feedback session. The module also serves to prepare students for their Bachelor's thesis, both in terms of content and methodology.

Key content includes:
- Analysis of practical use cases of mobile systems within an academic context
- An initial introduction to academic working techniques and text types (paper, abstract, discussion)
- Development of sound research questions in the context of mobile/ ubiquitous systems
- Literature review, theory development, methodological approach
- Academic writing and structuring
- Discussion of ethical, societal or design implications
- Presentation techniques for academic talks
- Peer-review processes, feedback formats
- Linking application perspectives with research reflection

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Students will be able to:

- identify key theories, concepts and current research approaches in the field of mobile and ubiquitous systems (to remember)
- distinguish between academic research questions and practical project ideas, and embed them within a theoretical framework (to understand)
- to apply practical knowledge and academic methods (e.g. systematic literature review, theoretical modelling, exploratory analysis) to address a topic (to apply)
- to critically evaluate academic texts and construct their own argumentative structures (to analyse)
- to assess the quality, rigour and relevance of academic arguments in their own paper and in those of fellow students (to evaluate)
- to write an (initial) independent academic paper on a topic in the field of mobile and ubiquitous systems and to present it professionally (to create)

**Literature**
Kornmeier, M. (2022). Academic Writing Made Easy. Springer
Flick, U. (2023). Social Research: Methods and Applications. Rowohlt
Rogers, Y., Sharp, H., & Preece, J. (2023). Interaction Design. Wiley
Schmidt, A., & Kranz, M. (2017). Mobile Interaction. Oldenbourg
Weiser, M. (1999). The Computer for the 21st Century. Scientific American

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# Module: 6322200
# Virtual Reality

## Module profile

**Exam number**
6322200

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction, Exercise

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Stefan Sauer

**Lecturer(s)**
Stefan Sauer

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
This event is organised by the Faculty of Plastics Technology and Surveying (FKV):
(https://geo.thws.de/studium/bachelor-geovisualisierung/studienablauf/modulhandbuch-bgv-ab-ws-202223/)

For the schedule: https://geo.thws.de/studium/aktuelle-lehrveranstaltungsplaene/

- Creating 3D models for integration into game engines
- Working with game engines
- Rendering pipeline
- Integration of VR functionalities into game engines
- Creation of fully functional 3D models in game engines
- Development of virtual tours

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Upon completion of the module, students will be able to independently plan, develop and set up VR applications, or publish them using appropriate services.

Game engines are used to create VR environments. Students therefore learn the basics of importing and working with geodata in game engines, as well as the settings for rendering and preparing the data for VR applications, including the programming of controllers and the interface with VR headsets.

**Literature**
Akenine-Möller, T.; Haines, E.; Hoffman, N.; Pesce, A.; Iwanicki, M.; Hillaire, S.: Real-Time Rendering, 2018, 4th edition, Milton: Chapman and Hall/CRC, London, ISBN: 9781138627000 Edler, D.; Husar, A.; Keil, J.; Vetter, M. & Dickmann, F.: Virtual Reality (VR) and Open Source Software: A Workflow for Constructing an Interactive Cartographic VR Environment to Explore Urban Landscapes, 2018. In: Kartographische Nachrichten, Journal of Cartography and Geographic Information, 68(1), pp. 5–13, ISSN: 2524-4965
Edler, D.; Kühne, O.; Jenal, C.; Vetter, M.; Dickmann, F.: The Potential of Spatial Visualisation in Virtual Reality (VR) for Social Constructivist Landscape Research, 2018. In: Kartographische Nachrichten, Journal of Cartography and Geographic Information, 68(5), pp. 245–254, ISSN: 2524-4965
Vetter, M.: Technical Potential for Visualisation in Virtual Reality, 2020. In D. Edler, C. Jenal, & O. Kühne (Eds.), Modern Approaches to the Visualisation of Landscapes, 2020, Wiesbaden: Springer VS, ISBN: 978-3-658-30956-5

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# Module: 5003855
# Web Exploitation

## Module profile

**Exam number**
5003855

**Duration**
1 semester

**Frequency**
Every summer semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Sebastian Biedermann

**Lecturer(s)**
Prof. Dr.-Ing. Sebastian Biedermann

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC |
| **Semester according to SPO** | 6. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
None

**Content**
Students learn about the professional role and methodological workflow of web penetration testers, including legal and ethical frameworks. Techniques for identifying and exploiting common web vulnerabilities (e.g., OWASP Top Ten) in front-ends, back-ends and APIs are taught. Web post-exploitation scenarios (e.g. web shells, session hijacking, API abuse) and related containment considerations are practised in isolated lab environments. Finally, students practise structured reporting and the presentation of findings in a manner appropriate to the target audience.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
None

**Learning outcomes**
Upon completion of the module, students will be able to:

- describe the professional role of web penetration testers and their responsibilities within IT security.
- outline the typical workflow of a web penetration test (reconnaissance → enumeration → exploitation → post-exploitation → reporting).
- identify legal constraints, scope boundaries and ethical considerations, and incorporate them into test planning.
- identify common web vulnerabilities (e.g., injection, XSS, CSRF, authentication issues) in test applications and produce reproducible proofs of concept.
- perform web post-exploitation techniques (e.g., session takeover, web shells, API abuse) in a laboratory setting and analyse their effects.
- Assess discovered vulnerabilities in terms of exploitability and business impact (e.g., using CVSS criteria) and set priorities for remediation.
- Document the results of a web penetration test in a structured report and present key findings in a manner appropriate to the target audience.

**Literature**
The Web Application Hackers' Handbook (Dafydd Stuttart et al.), 2023
Penetration Testing – A Hands-On Introduction to Hacking (Georgia Weidman), 2014
Hacking, The Next Generation (Nitesh Dhanjani et al.), 2021

# 7. semester

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# Module: 5003028
# ABAP/4 Development Workbench

## Module profile

**Exam number**
5003028

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Martin Espenschied

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
Fundamentals of Programming with ABAP
- Overview of the ABAP programming language
- Creating and testing an ABAP report
- Output statements
- Program data – types and variables
- Multilingual support – text elements
- Reading database tables
- Control statements
- Program data – field strings and internal tables
- Modularisation using function modules and classes

Dialogue programming
- Dialogue programmes from the developer's perspective
- Developing a simple dialogue programme
- The graphical elements of a screen
- Importing definitions from the Data Dictionary
- The Menu Painter
- Dynamic screen sequence
- Field input checks/messages
- Dynamic screen modifications
- Database changes and locks

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students are familiar with the architecture and use of the ABAP/4 Development Workbench.
They can create simple programmes using SAP-specific statements. They can analyse and rectify errors. They can create function modules and classes, and design user interfaces.

**Literature**
ABAP Development for SAP S/4HANA by Constantin-Catalin Chiuaru, Sebastian Freilinger-Huber, Timo Stark and Tobias Trapp, Rheinwerk-Verlag, 2nd edition, Bonn 2021.
ABAP – The Comprehensive Handbook by Felix Roth, Rheinwerk-Verlag, 3rd edition, Bonn 2023.
Agile ABAP Development by Winfried Schwarzmann, Rheinwerk-Verlag, Bonn 2018.
BOPF – Developing Business Objects with ABAP by Felix Roth and Stefan Stöhr, Rheinwerk-Verlag, Bonn 2017.

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# Module: 5003180
# Advanced Database Techniques

## Module profile

**Exam number**
5003180

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Peter Braun

**Lecturer(s)**
Michael Rott

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Databases, Databases I, Back-end Systems

**Content**
As part of this module, students acquire practice-oriented and interdisciplinary skills in the field of modern database management. The course content is designed to link technological fundamentals with current requirements from industry and research.

In particular, the following aspects are covered:

- An in-depth examination of the CAP theorem, taking real-world distributed database systems into account.
- The systematic selection of suitable database management systems (DBMS) based on specific deployment scenarios. These include both relational (e.g. PostgreSQL, MySQL, SQL Server, Oracle) and non-relational systems (e.g. MongoDB, Redis, Riak).
- Use of a data modelling tool (e.g. erwin Data Modeler) to create conceptual and physical data models.
- Use and evaluation of monitoring and performance tools, particularly with regard to load balancing, system monitoring and the analysis of query execution plans.
- Investigation of various fragmentation strategies for the efficient storage and management of large volumes of data in distributed database systems.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**

- Students recall the fundamental concepts, terminology and architectures of relational database systems.
- Students understand the structure and functioning of various database management systems (DBMS).
- Students apply relational modelling techniques to create conceptual data models (e.g. ER diagrams).
- Students analyse requirements for database systems in order to select suitable technical solutions.
- Students evaluate simple database designs in terms of freedom from redundancy, normalisation and performance.
- Students create relational database schemas using appropriate modelling and implementation tools.

**Literature**

Kofler, Michael: Database Systems – The Comprehensive Textbook; 2nd ed.; Rheinwerk Verlag; Bonn, 2024
Heuer, Andreas; Saake, Gunter: Databases – Concepts and Languages; 6th ed.; MITP-Verlag; Bonn, 2018
Rahm, Saale, Sattler: Distributed and Parallel Data Management; Springer Vieweg; Berlin Heidelberg, 2015

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# Module: 5003847
# Algorithms for Distributed Systems

## Module profile

**Exam number**
5003847

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Erik Schaffernicht

**Lecturer(s)**
Prof. Dr.-Ing. Erik Schaffernicht

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Courses on computer networks and communication (e.g. Internet communication, backend systems), algorithms and data structures, and the basics of operating systems

**Content**
Introduction/recap on communication models for distributed systems
- Remote procedure calls
- Blackboards and event-based models

Fundamentals of distributed algorithms
- Differences between algorithms in distributed systems, parallel algorithms and single-machine algorithms
- Consensus problems
- Failure models
- Physical clocks and logical clocks

Algorithms for common problems in distributed systems
- Coordination
- Leader election
- Searching
- Fault tolerance / fault handling
- Consistent data replication

The course will be taught in English.
The course is programming language-agnostic; students may choose their preferred languages to implement seminar assignments.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
none

**Learning outcomes**
Upon completion of the course, students will be able to

- understand the capabilities and limitations of distributed systems,
- explain different failure models,
- use remote procedure call frameworks to programme in distributed systems,
- design and implement solutions to common problems in distributed systems,
- select algorithms to manage conflicts and failures in distributed systems,
- discuss the main challenges in distributed systems, both in general and for specific tasks,
- compare different algorithmic solutions to common problems in distributed systems and discuss potential trade-offs

**Literature**
M. van Steen and A.S. Tanenbaum, *Distributed Systems*, 4th ed., 2023
Further specific reading recommendations will be provided during the course

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# Module: 5003828
# Automotive and Industrial Cybersecurity

## Module profile

**Exam number**
5003828

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Sebastian Biedermann

**Lecturer(s)**
Dr.-Ing. Rodrigo Daniel do Carmo

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
Part I: Automotive Cybersecurity

Introduction to Automotive Cybersecurity
- Architecture of Modern Vehicles
- Cybersecurity Challenges of Modern Vehicles and E/E Architectures

Legislation and Standardisation for Cybersecurity in the Automotive Industry
- Introduction to Automotive Cybersecurity Regulations and Standards: UN ECE WP.29 and UN Regulations Nos. 155 and 156, Vehicle Type Approval, Overview of Global and European Approaches
- Introduction to the International Standard ISO/SAE 21434
- Related and Upcoming Standards

Automotive Threat Analysis and Risk Assessment (TARA) According to ISO/SAE 21434
- Introduction to Risk Management and TARA
- Scope of a TARA, Attacker Model, Item Definition
- Asset Identification (Typical Assets for Automotive Embedded Systems)
- Cybersecurity Properties (CIA Triad and Other Properties)
- Definition of Damage Scenarios
- Identifying Threats: Overview of Threat Modelling, STRIDE, Brainstorming, MITRE ATT&CK, OWASP
- Definition of Attack Paths: Identification and Description of Attack Paths, Attack Trees, Vulnerabilities
- Attack Feasibility Evaluation
- Risk Evaluation
- Risk Treatment Decision: Cybersecurity Goals
- Cybersecurity Requirements, Typical Controls for Automotive Embedded Systems

Part II: Industrial Cybersecurity

Introduction to Industrial Networks and Control Systems
- Industrial Security, Basic Process Control Systems, Differences Between IT and OT Systems

- Components and Architecture of Industrial Control Systems: Field Devices, Programmable Logic Controllers, Distributed Control Systems, Supervisory Control and Data Acquisition (SCADA) Systems, Network Transmission Media, Field Device Architecture, Industrial Network Protocols, Enterprise Network Protocols, Industrial Safety and Protection Systems, Safety Instrumented Systems (SIS), OT/IT Network Integration, Purdue Reference Model

Industrial Cybersecurity and Secure OT Architectures

- Introduction to Cybersecurity Challenges in Modern Industry (Industry 4.0): Examples of Attacks, MITRE ATT&CK Database, SHODAN
- Overview of Relevant EU Cybersecurity Regulations: NIS2, Cyber Resilience Act (CRA), Machinery Regulation, Radio Equipment Directive (RED)
- Secure OT Architecture: Boundary protection, firewalls, industrial demilitarised zone, proxies, network zoning, data diode, zero-trust architecture (ZTA)

The International Standard IEC 62443

- Overview of the International Standard ISA/IEC 62443
- Basic Terminology
- Security of Industrial Networks: Security Programme, the Automation Solution Security Lifecycle, Security Levels and Maturity Levels, Security Objectives and Foundational Requirements, Defence-in-Depth Principle, Threat-Risk Assessment, Security Zones and Conduits
- Product Security: Risk-based Approach and Relationship to the Cyber Resilience Act, Security Levels and Functional Requirements, Secure Development Lifecycle

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**

- Students understand the architecture and cybersecurity challenges of modern vehicles, including the basics of E/E architectures.
- Students are familiar with the essentials of risk management and threat modelling, including terminology, standards and methods for conducting threat analysis and risk assessment (TARA) in both automotive and industrial contexts.
- Students are familiar with fundamental cybersecurity protection concepts for industrial control systems (ICS), understand the differences between OT and IT, understand the terminology and concepts of the IEC 62443 standard, and are aware of relevant guidelines and new European regulations.
- Students are capable of carrying out comprehensive threat analysis and risk assessment (TARA) for automotive systems and industrial/operational technology (OT) environments, identifying vulnerabilities and evaluating risks.
- Students are able to manage and develop the deliverables of automotive development projects in accordance with the international standard ISO/SAE 21434.
- Students can design and implement secure network architectures for industrial systems, applying principles such as zoning, Zero Trust and defence-in-depth.
- Develop analytical, structured and logical thinking skills to systematically evaluate and address cybersecurity challenges in both automotive and industrial contexts.
- Enhance abstraction skills to understand and apply complex cybersecurity concepts, standards and risk management techniques.

**Literature**


- N. Ferguson, B. Schneier, T. Kohno, “Cryptography Engineering – Design Principles and Practical Applications”, Wiley, 2010
- C. Paar, J. Pelzl, “Understanding Cryptography – A Textbook for Students and Practitioners”, Springer, 2010
- M. Rosulek, “The Joy of Cryptography”, 2021. URL: https://joyofcryptography.com
- L. Van Houtven, “Crypto 101”, 2013. URL: https://www.crypto101.io
- C. Smith, “The Car Hacker’s Handbook: A Guide for the Penetration Tester”, 1st ed. No Starch Press, San Francisco, 2016
- M. Wurm, “Automotive Cybersecurity: Security Components for Automotive Embedded Systems”, Springer Berlin Heidelberg, Berlin, Heidelberg, 2022
- A. Shostack, “Threat Modelling: Designing for Security”, 1st ed. Wiley Publishing, 2014
- ISO/SAE 21434:2021, “Road vehicles – Cybersecurity engineering”, International Standard
- R. do Carmo, A. Schlensog, “Automotive Threat Analysis and Risk Assessment in Practice”, Springer, 2024
- IEC 62443 International Series of Standards (Parts 1-1 to 4-2)
- The MITRE Corporation, MITRE ATT&CK®. URL https://attack.mitre.org/
- OWASP Foundation, “OWASP Top Ten”. URL https://owasp.org/www-project-top-ten/

- C. Brooks, P. Craig, “Practical Industrial Cybersecurity – ICS, Industry 4.0, and IIoT”, Wiley, 2022
- P. Kobes, “Guideline Industrial Security: IEC 62443 is easy”, VDE Verlag, 2023
- NIST SP 800-82r3, “Guide to Operational Technology (OT) Security”, 2023
- P. Ackermann, “Industrial Cybersecurity – Second Edition: Efficiently monitor the cybersecurity posture of your ICS environment”, Packt Publishing, 2021

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# Module: 5003600
# Bachelor Thesis / Bachelor Seminar

## Module profile

**Exam number**
5003600

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
1

**ECTS-Credits (CP)**
15.0

**Workload**
*Guided study time:*
Presence time: 40 hrs

*Self-study: 410 hrs*

*Total: 450 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Prof. Dr. Frank Hennermann,
Prof. Dr. Karsten Huffstadt,
Prof. Dr. Michael Müßig,
Prof. Dr. Gabriele Saueressig,
Prof. Dr. Kristin Weber,
Prof. Dr. Eva Wedlich,
Prof. Dr. Frank-Michael Schleif,
Prof. Dr. habil. Nicholas Müller

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | Compulsory module |

**Required prerequisites for the participation in the module according to the SPO**
120 ECTS credits, all modules from the first two semesters, as well as soft skills and professional skills modules, a practical module and a project assignment

**Recommended prerequisites for the participation in the module**
none

**Content**
The Bachelor's thesis module comprises the Bachelor's thesis (12 CP) and the Bachelor's seminar (3 CP).

The Bachelor's thesis involves independent study and research into the state of the art and current scientific knowledge within the relevant subject area. The thesis must abstract from constraints which, by their very nature, are not technically justified but arise from the specific circumstances of the company. Where software engineering solutions are required as part of the assignment, this generally means that prototypes are to be implemented; however, ensuring product specifications (including accompanying manuals, etc.) is not included. In the Bachelor's seminar, the fundamentals of academic work are taught and practised.

In the standard degree programme, the topics for the practical examples used in the examination are provided by the lecturer or agreed with them. In the dual study programme, a task from a real-world business context is worked on in consultation with the lecturer.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Thesis, Presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
Through their Bachelor's dissertation or seminar, students demonstrate that they are capable of independently tackling a challenging problem in business informatics (which may be interdisciplinary) and, in doing so, have a firm grasp of the methodological and academic foundations of the subject, as well as being able to present their findings appropriately.

**Literature**
depending on the topic set; academic literature must be thoroughly reviewed, utilised and cited in accordance with the topic

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# Module: 5003848
# Big Data Analytics

## Module profile

**Exam number**
5003848

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Isabel John

**Lecturer(s)**
Prof. Dr. Rajesh Ramachandran

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
- Basic programming knowledge (Java/Python)
- Prior experience with databases and Linux is recommended

**Content**
This comprehensive course provides an in-depth introduction to Big Data technologies, focusing on Hadoop and its ecosystem. Participants will learn core concepts such as the Big Data 4 Vs, types of analytics and Hadoop architecture, followed by hands-on programming skills using MapReduce, Hadoop Streaming, Pig, Hive and Kafka. The modules combine theoretical knowledge with practical projects, including real-world case studies and an integrated data pipeline, preparing learners to handle large-scale data processing and analytics.
The course covers the following content:
- Understanding Big Data concepts, including the 4 Vs and types of analytics
- Overview of the Hadoop ecosystem and architectural components
- Programming with MapReduce using Java, including advanced techniques
- Developing Hadoop Streaming applications with Python/Shell scripts
- Exploring real-world case studies and mini-projects to gain practical experience
- Data analysis using Pig Latin and scripting operators
- Building data warehousing solutions using Hive and HiveQL
- Learning about Kafka's architecture, key topics and data pipeline integration
- Hands-on exercises with HDFS, YARN, Pig, Hive and Kafka
- Final project focusing on designing an end-to-end data processing pipeline

The course combines on-site teaching in Würzburg (one week in October) with online teaching for the remainder of the semester

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of this module, students will be able to:

- LO1: Explain the fundamental characteristics of Big Data systems and analytics.
- LO2: Operate Hadoop HDFS and carry out distributed storage and processing.
- LO3: Implement MapReduce programmes using Java, including advanced features such as distributed caches and joins.
- LO4: Use Pig Latin and HiveQL for high-level querying of large datasets.
- LO5: Demonstrate an understanding of real-time streaming using Apache Kafka.
- LO6: Develop integrated solutions using multiple components of the Hadoop ecosystem.

**Literature**
Tom White, *Hadoop: The Definitive Guide* (2012), O'Reilly
Garry Turkington, Hadoop Beginner's Guide (2013), Packt Publishing
Pethuru Raj et al., High-Performance Big Data Analytics (2015), Springer
Official Apache Docs: Hadoop, Pig, Hive, Kafka (2018)

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# Module: 5003188
# Blockchain and Smart Contracts

## Module profile

**Exam number**
5003188

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Tobias Fertig

**Lecturer(s)**
Prof. Dr.-Ing. Tobias Fertig

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BDGD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
In this module, students gain a deep understanding of blockchain technology and smart contracts. After learning the basics, students are divided into teams to develop prototypes for suitable use cases. By the end of the module, students are able to evaluate use cases and implement them in practice.

The following content is taught to students:
- Evaluating use cases
- How blockchains work
- How the various consensus models work
- Introduction to contract-oriented programming
- Introduction to Solidity and suitable development environments
- Introduction to programming smart contracts
- Testing and debugging smart contracts
- Common design patterns for smart contracts
- Deployment and management of smart contracts
- Basics of decentralised applications (DApps)
- Frameworks for programming DApps
- Development of DApps
- Deployment of DApps
- Testing of DApps

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
none

**Learning outcomes**
1. Students recall the basic concepts of blockchain technology and its functionalities.
2. Students understand the principles and functioning of smart contracts and their significance within the blockchain ecosystem.
3. Students apply the Solidity programming language to develop and implement smart contracts.
4. Students develop decentralised applications (DApps) for the Ethereum blockchain and integrate smart contracts.
5. Students analyse security vulnerabilities in smart contracts and are able to formulate and implement strategies to mitigate these risks.

**Literature**
https://www.rheinwerk-verlag.de/blockchain-the-comprehensive-guide-to-blockchain-development-ethereum-solidity-and-smart-contracts/

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# Module: 100000
# Business Intelligence and Reporting

## Module profile

**Exam number**
100000

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 0 hrs

*Self-study: 150 hrs*

*Total: 150 hrs*

**Teaching format**
Lecture

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank-Michael Schleif

**Lecturer(s)**

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
This is a programme offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20773,84,1508,1

**Recommended prerequisites for the participation in the module**
This is a programme offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20773,84,1508,1

**Content**
This module currently replaces the ‘Business Intelligence’ course in the Business Technologies specialisation.
As such, it can only be selected once, either as a FWPM or (exclusively) for the ‘Business Intelligence’ course.
If the BT specialisation is chosen, the module is recognised as Specialisation I.

This is a course offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20773,84,1508,1

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
This is a programme offered by the Virtual University of Bavaria.
Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20773,84,1508,1

**Literature**
This is a programme offered by the Virtual University of Bavaria.
Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20773,84,1508,1

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# Module: 5003804
# Cloud Native Enterprise Java

## Module profile

**Exam number**
5003804

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Rolf Schillinger

**Lecturer(s)**
Matthias Reining

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Programming skills in Java

**Content**
This course covers the fundamentals of Jakarta EE (https://jakarta.ee/), also known by its former name, Java EE (EE: Enterprise Edition).
The course focuses on the development of modern cloud-native enterprise applications, organised into the following topics:

- General requirements for business applications
- Web services (JAX-RS – RESTful web services)
- Enterprise software patterns (CDI – Context and Dependency Injection)
- Data persistence (JPA – Java Persistence API)
- Use of microservice architecture patterns (via Microprofilehttps://microprofile.io/)
- Different runtimes (on-premises and cloud)

The majority of the topics will be demonstrated and discussed directly using source code and live-coding examples.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- Distinguish between terms such as Java, Java EE and Jakarta EE, and contextualise buzzwords from the Java Enterprise world.
- to efficiently implement applications in different runtime environments based on the Jakarta EE APIs
- to design and implement microservice architectures using Jakarta EE / Quarkus
- to use Docker in the Jakarta EE / Quarkus environment
- to analyse Docker cloud deployments.

**Literature**
https://eclipse-ee4j.github.io/jakartaee-tutorial/
https://jakarta.ee/
https://microprofile.io/
https://www.adam-bien.com/roller/abien/

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# Module: 5003082
# Computer Graphics

## Module profile

**Exam number**
5003082

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Deinzer

**Lecturer(s)**
Prof. Dr. Frank Deinzer

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Linear Algebra, knowledge of C++

**Content**
Theoretical topics
- Mathematical foundations of computer graphics
- Fundamentals of physically based lighting
- Ray tracing

Algorithmic topics
- Overview of fundamental computer graphics algorithms
- Lighting
- Texturing
- Shadows
- Volume rendering

Practical topics
- Computer graphics with OpenGL
- Implementation of ray tracing
- Shader programming

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Colloquium

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students broaden and deepen their knowledge in the field of 'computer graphics' and acquire the skills to analyse and structure complex problems.
Students understand problems in the field of 'computer graphics', analyse them and develop solutions.
As part of their assignments, students apply their knowledge in a practical context.
Students develop high-performance computer graphics applications.
Students understand the mathematical principles underlying computer graphics.

**Literature**
Foley, van Dam, Feiner: Fundamentals of Computer Graphics. Introduction, Concepts, Methods. Addison Wesley, 1999
Zeppenfeld, K.: Textbook of Graphics Programming: Fundamentals, Programming, Applications. Spektrum Akademischer Verlag, 2003
Peter Shirley: Fundamentals of Computer Graphics. AK Peters LTD, 3rd edition, 2009
Hearn, Baker, Carithers: Computer Graphics with OpenGL. Prentice Hall, 4th edition, 2010
Matt Pharr, Greg Humphreys: Physically Based Rendering, Second Edition: From Theory to Implementation, Morgan Kaufmann, 2010

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# Module: 5003814
# Digital Accessibility

## Module profile

**Exam number**
5003814

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Tobias Aubele

**Lecturer(s)**
Joschi Kuphal

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI, BDGD, BISD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Experience in the design and/or development of web applications (HTML, CSS, JavaScript)

**Content**
The event is divided into theoretical and practical sections, each with a specific focus on digital accessibility:

- Fundamentals of digital accessibility, design and development models
- Types of disability, assistive technologies and adaptation strategies
- Types and mechanisms of barriers, and the allocation of responsibilities
- Relevant standards, norms and legislation supporting accessibility in national and international contexts
- Strategies for implementing accessible design and development processes
- Identifying, reducing and preventing barriers in digital media: the web, documents (e.g. MS Word, MS PowerPoint, PDF, e-books), audio-visual media (e.g. video, audio)
- Conceptualisation, design, implementation and testing of accessible web applications
- Setting up and using screen readers and other assistive technologies

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students are familiar with various conceptual and design approaches associated with accessibility, and are aware of their similarities and differences.

- They are familiar with the most common types of disability and can characterise the prevailing models of understanding in society and academia.
- They understand demographic trends and are familiar with the key statistics on disability worldwide, in Europe and in Germany.
- They can identify various types of barriers that arise when interacting with digital products. They are familiar with assistive technologies and adaptation strategies for overcoming these barriers.
- You are familiar with the standards, norms and laws relevant to accessibility at various levels (global, European, D-A-CH) and understand how they relate to one another.
- You have internalised the benefits of accessible design at a personal, societal and business level and are familiar with strategies for implementing and embedding accessibility within organisations and development processes.
- You understand the barriers that can arise in various digital media (the web, documents, multimedia systems, e-books, apps, software, terminals, etc.) and are familiar with the principles, techniques and tools for identifying, reducing and preventing barriers.
- You will have in-depth knowledge of the conception, design and implementation of accessible web applications; you will be able to evaluate them for accessibility and will be familiar with relevant testing tools and methods.
- You have the skills to check, assess and correct digital documents for accessibility, as well as to create accessible documents independently.
- You are familiar with the use of common screen readers on different platforms and are able to set up a suitable testing environment for assessing web and other applications.

**Literature**

- Alexander, Kerstin (2019) — Image & Type: Communicating Accessibly through Typography and Images, Frank & Timme
- Aubele, Tobias; Gierke, Detlef (2025) — Accessible Websites, Rheinwerk Verlag
- Kalbag, Laura (2017) — Accessibility for Everyone, A Book Apart
- Matuzović, Manuel (2024) — Web Accessibility Cookbook: Creating Inclusive Experiences, O'Reilly
- Miller, Susi (2021) — Designing Accessible Learning Content, Kogan Page
- Pickering, Heydon (2018) — Inclusive Components: The Book, Smashing
- Silver, Adam (2018) — Form Design Patterns, Smashing

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# Module: 5003830
# Introduction to SAP Business Technology Platform

## Module profile

**Exam number**
5003830

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Christian Fink

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
SAP user skills

**Content**

- What is the SAP Business Technology Platform (SAP BTP)?
- History of SAP BTP
- SAP's strategy for SAP BTP
- How is the BTP structured?
- What services does SAP BTP include?
- Technical aspects of SAP BTP
- Overview of SAP BTP use cases, such as side-by-side extension, clean core, integration, analytics and AI, low-code/no-code
- Reference architectures with and without S/4HANA

SAP BTP Customisation

- Basic customisation
- Roles and authorisations
- Setting up sample applications

o A first app in SAP BTP
o Configuring the Work Zone
o Clean Core with S/4HANA
o Setting up an integration scenario
o First integration of generative AI

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
1. Students are familiar with the fundamental concepts and definitions of the SAP Business Technology Platform (SAP BTP) and its historical development.
2. Students understand the strategic significance of SAP BTP and its role within the context of corporate digitalisation strategies.
3. Students explain the structure and architecture of SAP BTP, as well as the services it contains and their functions.
4. Students apply basic customisation techniques to adapt SAP BTP to specific use cases.
5. Students analyse various areas of application for SAP BTP, such as side-by-side extensions, integration and analytics, as well as low-code/no-code approaches.
6. Students evaluate reference architectures for SAP BTP, including its integration with S/4HANA and the development of integration scenarios.

**Literature**
SAP Business Technology Platform – Administration, Martin Koch, Siegfried Ziegler, Rheinwerk-Verlag, Bonn 2024, ISBN 978-3-367-10020-0.
SAP Integration Suite, Jan Arensmeyer, Enrico Hegenbart, Rheinwerk-Verlag, Bonn 2024, ISBN 978-3-8362-9933-6
Enterprise Content Management with SAP, Christian Fink, Rheinwerk-Verlag, Bonn 2019, ISBN 978-3-8362-6524-9

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# Module: 5003851
# Ethical Hacking (Blended Intensive Program)

## Module profile

**Exam number**
5003851

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Tobias Fertig

**Lecturer(s)**
Prof. Dr.-Ing. Tobias Fertig,
Franziska Königer

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
n/a

**Recommended prerequisites for the participation in the module**
Before the course unit, learners/students are expected to have a basic understanding of computer networking, Linux, programming and the fundamentals of ML/AI.

**Content**
This intensive ethical hacking training programme focuses on ethical hacking techniques and practices. The 2025 programme is geared towards network and AI security, and typically covers topics such as attacks on AI systems, penetration testing, vulnerability assessment, IDS, packet analysis, various testing and hacking tools, and defensive strategies. Participants can expect hands-on training and real-world simulations to enhance their ethical hacking skills. Team-based learning approaches will be employed. A competition will take place at the end. By the end of the programme, participants should be equipped with the knowledge and tools needed to carry out ethical hacking assessments, identify security weaknesses, and recommend solutions to strengthen cybersecurity defences.

This course will be delivered as a blended intensive programme comprising several online sessions and a study trip to Kaunas, Lithuania.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
n/a

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
n/a

**Learning outcomes**

- The students explain the fundamental ethical and legal principles of ethical hacking and establish effective teamwork practices.
- The students present their technical findings in clear oral and written presentations to a variety of audiences.
- Students set up a controlled simulation environment (cyber range) to practise and test their skills safely.
- Students analyse full packet captures using Wireshark to identify protocols, data flows and indicators.
- Students classify common cyber security attacks and select appropriate tools for safe reproduction and analysis.
- Students design basic penetration tests and interpret IDS outputs to assess detection and response.
- Students evaluate vulnerabilities in AI systems and propose defence strategies against adversarial attacks.
- Students plan a continuous-learning roadmap, selecting tools and resources that build knowledge and self-confidence.

**Literature**
This will be announced during the lesson.

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# Module: 5003827
# Governance, Risk, Compliance and Ethics (FWPM)

## Module profile

**Exam number**
5003827

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Kristin Weber

**Lecturer(s)**
Prof. Dr. Kristin Weber,
Prof. Dr. Markus Oermann

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
ISM Standards & Processes

**Content**
Many individuals and units, both within and outside organisations, are involved in information security management. Governance ensures that transparency, accountability and efficiency are maintained by establishing structures, responsibilities and framework conditions, whilst safeguarding the interests of all stakeholders. This module outlines the stakeholders involved in information security management, how responsibilities are defined, decisions are made and optimal conditions are created to ensure maximum information security.

The identification and assessment of IT risks help organisations to address threats to information security in a targeted and structured manner. The risk-based approach is adopted in many ISMS (Information Security Management System) frameworks. This module covers the fundamentals of IT risk management, including measures for identifying, analysing, assessing and addressing IT risks within a structured risk management process.

The section on ethics explains the essential conceptual foundations of moral philosophy. Drawing on established schools of ethics, it examines the normative justification of (information) security as a value and a guiding principle for action. The examination of models for integrating ethical considerations into development and system design processes bridges the gap to the practical application of ethical principles. In this context, issues of compliance with current data protection legislation are also of particular relevance. Following an overview of its basic structures, the focus is on the requirements for technical and organisational data protection, as well as on the enforcement of the law and the consequences of legal breaches. Finally, the fundamentals of the reformed information security legislation are explained.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon completion of the module, students will be able to:

- identify and specifically design fundamental governance mechanisms (e.g. responsibilities, guidelines, decision-making processes, committees) in the context of information security.
- describe relevant roles and stakeholders in information security management both within and outside organisations, and outline their responsibilities in detail.
- explain the significance and function of IT risk management for information security and illustrate this using practical examples.
- Identify and describe the organisational framework for effective IT risk management.
- Understand, apply and document a simple, structured IT risk management process.
- Recognise ethical challenges in dealing with digital systems relevant to security and develop approaches for integrating ethical principles into work processes.
- Explain the basic structures of data protection law and answer fundamental questions regarding data protection compliance.
- Describe the key elements of information security law and assess their relevance to business practice.
- Communicate effectively with legal or regulatory experts on issues relating to data protection and information security law.
- reflect on the interrelationships between governance, risk and compliance management, and ethics in security-critical IT environments.

**Literature**
Green, J.: Information Security Management Principles. 4th ed., BCS, 2024. (esp. ch. 1 to 3)
Harich, T.: IT Security Management – The Comprehensive Practical Handbook, 4th ed., mitp, 2025.
Harkins, M.: Managing Risk and Information Security: Protect to Enable. 2nd ed. Apress, 2016.
Johannsen, A.; Kant, D.: IT Governance, Risk and Compliance Management (IT-GRC) – A Competence-Based Approach for SMEs. In: HMD – Praxis der Wirtschaftsinformatik, 57, 2020, pp. 1058–1074. https://doi.org/10.1365/s40702-020-00625-8
Kersten, H. et al.: IT Security Management in accordance with the new ISO 27001 – ISMS, Risks, Key Performance Indicators, Controls. 2nd, updated edition, Springer-Verlag, 2020.
Lang, M.; Löhr, H.: IT Security – Technologies and Best Practices for Implementation in Organisations. 2nd, revised edition, Hanser, 2024.
Lewinski/Rüpke/Eckhardt (2022): Data Protection Law. 2nd edition. Munich, C.H. Beck.

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# Module: 5003831
# Basics Consumer Psychology

## Module profile

**Exam number**
5003831

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Tobias Aubele

**Lecturer(s)**
Juliane Richter

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
Fundamentals of Consumer Psychology
- Introduction to consumer psychology
- Behavioural science as the basis of consumer behaviour
- Psychological models of the purchasing decision

Psychology of the purchasing decision
- Perception and attention
- Learning and memory
- Motivation and Needs
- Emotions in Consumption
- Attitudes and Attitudinal Change
- Decision-Making Processes
- Heuristics and Biases

Applied Psychology in E-commerce
- Customer Journey and Consumer Experience
- Trust in Online Retail
- Social proof and digital recommendations
- Choice architecture and nudging
- Behavioural design
- Personalisation and recommendation systems
- Conversion optimisation from a psychological perspective

Current developments
- Behavioural AI
- Social influences on purchasing decisions / social commerce
- Influencer marketing
- Neuromarketing
- Dark patterns
- Ethical and legal aspects of psychological influence

All course content is taught in a practical manner using concrete examples, case studies, psychological experiments and group exercises.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students learn about the psychological foundations of consumer behaviour in e-commerce. They come to understand how perception, attention, emotions, motivation, attitudes and social influences shape purchasing decisions, and how psychological insights can be applied to design successful customer journeys.
Students acquire the ability to analyse consumer behaviour on a scientifically sound basis, to critically evaluate current developments and to apply psychological principles to specific issues in digital commerce. In doing so, they examine both the opportunities and the ethical limits of applying psychological insights.

1. Students understand the psychological foundations of consumer behaviour.
Students are familiar with the key psychological processes of information processing and understand their influence on purchasing decisions. They are familiar with fundamental models of consumer psychology and their significance for e-commerce.
Students can explain the psychological mechanisms behind purchasing decisions and provide scientific justifications for different behaviours.
Students learn to interpret psychological models and apply them to questions of consumer behaviour.

2. Students can apply psychological insights to purchasing decisions in e-commerce.
Students understand how perception, attention, emotions, motivation, attitudes, as well as heuristics and cognitive biases influence consumer behaviour.
They can identify and evaluate psychological influencing factors in digital customer journeys and derive appropriate measures to optimise purchasing decisions.
Students apply psychological models to real-world issues in online retail and analyse existing digital applications.
They present their analyses clearly and discuss different solution approaches in a well-reasoned manner.
As part of practical case studies, students work together to develop recommendations for action for businesses.
Personal competence
Students critically reflect on their own consumer decisions and develop an awareness of psychological influence mechanisms in everyday life.

3. Students understand the application of psychological insights throughout the customer journey.
Students are familiar with the key psychological factors influencing digital purchasing decision-making processes and understand their significance for customer experience, conversion and customer loyalty.
They are able to assess the psychological design possibilities of various touchpoints and identify potential for optimisation.
Students analyse online shops, apps and digital platforms using psychological criteria and derive recommendations for action.
They develop the ability to independently apply psychological insights to new digital fields of application.

4. Students critically engage with current developments in consumer psychology.
Students are familiar with current trends and developments in consumer psychology within digital retail, particularly in the areas of personalisation, artificial intelligence, behavioural design, social commerce and digital decision architectures.
They are able to place new developments in a scientific context, assess opportunities and risks, and reflect on ethical issues.
Students learn to analyse current research findings critically and to assess their practical relevance.
Students reflect on their own role as consumers, as well as on the societal implications of psychological influence in digital commerce.

**Literature**

Felser, G. (2007). Advertising and Consumer Psychology. Heidelberg: Spektrum Akademischer Verlag.
Kirchler, E. M. (1995). Economic Psychology. Foundations and Fields of Application of Economic Psychology. Göttingen: Hogrefe.
Kroeber-Riel, W. (1992). Consumer Behaviour. Stuttgart: Vahlen.
Mattenklott, A. (2007). Emotional Advertising. In K. Moser (Ed.), Business Psychology (pp. 85–106). Heidelberg: Springer.
Moser, K. (2002). Market and Advertising Psychology. A Textbook. Göttingen: Hogrefe.
Neumann, P. (2013). Handbook of Market and Advertising Psychology. Bern: Huber.
Petty, R. E. & Cacioppo, J. T. (1986). Communication and Persuasion: Central and Peripheral Routes to Attitude Change. New York: Springer.
Wänke, M., & Florack, A. (2007). Brand Management. In K. Moser (Ed.), Business Psychology (pp. 108–127). Heidelberg: Springer
Wolfgang Stroebe, Klaus Jonas, Miles R. C. Hewstone (eds.): Social Psychology. An Introduction (original title: *Introduction to Social Psychology*, translated by Matthias Reis and Klaus Jonas). 6th edition, Springer, Berlin 2014

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# Module: 5003869
# Media and Communication Psychology: The Magic of Media & Entertainment

## Module profile

**Exam number**
5003869

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Christina Völkl-Wolf

**Lecturer(s)**
Nayomi Polcar

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
None

**Recommended prerequisites for the participation in the module**
None

**Content**
Why do we keep scrolling when we should have been asleep long ago? Why do characters in TV series sometimes feel almost like real people? How do advertising, games, social media, AI and robots influence the way we think, feel and behave?
In this seminar, we take a scientific look at the psychological magic of media and communication: from entertainment, identity and emotions to persuasion, mass communication and digital platforms. We combine theories and studies with examples from films, TV series, games, social media, advertising and human-technology interaction. The focus is on why media is effective, why communication is never neutral, and what effect all this has on us.

Media and communication psychology deals with traditional media such as radio, music, TV, streaming and books, as well as digital and interactive forms of media, including online and mobile communication, social media, games, computer-mediated communication, robots and new developments in media technology. It examines human behaviour, thought, emotion, action and communication in the context of media use, media experiences and communication processes.

The module covers key methods in media and communication psychology, motives behind media selection, processes of media reception, and the effects of media and communication offerings. It also addresses the individual underpinnings of communication: Why do people communicate? How do they perceive messages? And how do communication and the media influence our experiences, behaviour and social environment?
The aim of the module is to impart the psychological foundations of media use and communication and to apply them to key issues in media selection, media reception, media effects and mass communication. Students are introduced to theoretical approaches in media and communication psychology and explore motives such as entertainment, identity formation, social connection, the need for information, persuasion and emotional regulation.

Particular emphasis is placed on methods from media psychology and communication psychology, such as experimental designs,

reception studies, impact research and the analysis of communicative phenomena. In addition, current topics such as media addiction, algorithm-driven content, digital platforms, communication in advertising, computer-mediated communication and human-technology interaction are covered.

Entitled ‘Media and Communication Psychology: The Magic of Media & Entertainment’, the seminar combines a scientific foundation with illustrative examples from film, TV series, games, social media, advertising and digital communication. Students learn to critically evaluate media and communication phenomena and analyse them from a psychological perspective.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
None

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
None

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- describe the traditional, digital and interactive forms of media considered in media and communication psychology.
- explain how cognitive, emotional, social and motivational processes influence media usage and communication behaviour.
- analyse which individual and situational factors contribute to the choice of specific media formats, forms of communication and messages.
- apply theoretical models of media selection, media reception and communication – such as uses and gratifications, mood management or persuasion theories – to specific media phenomena.
- classify phenomena of mass communication and their psychological mechanisms of action.
- Assess the psychological effects of media consumption and media-mediated communication, for instance in social media, games, streaming services, advertising or computer-mediated communication.
- Reflect on how media experiences and communication processes contribute to identity formation, social orientation, emotional regulation and opinion formation.
- Develop their own research questions or study designs relating to the effects of media and communication.
- Discuss current media developments – such as algorithm-driven content, digital platforms, robots or human-technology communication – from a psychological perspective.

**Literature**
Wulf, T., Naderer, B., & Rieger, D. (2023). Media Psychology. Nomos.
Hennighausen, C., Lange, B. P., & Schwab, F. (2024). Evolutionary Media Psychology. In M. Hammerl, S. Schwarz & K. P. Willführ (Eds.), Evolutionary Social Sciences. A Survey (pp. 83–102). Springer VS. https://doi.org/10.1007/978-3-658-41860-7_5
Trepte, S., Reinecke, L., Gimmler, R., Gleich, U., Winter, S., Frischlich, L., Krämer, N., Appel, M., Hutmacher, F., Mengelkamp, C., Stein, J.-P., & Weber, S. (2023). Career paths in media psychology. University of Hohenheim. https://doi.org/10.18724/001c.81580
ZHAW Zurich University of Applied Sciences. (2023). JAMESfocus 2023: Mobile phone behaviour and sustainability – current trends. https://www.zhaw.ch/storage/psychologie/upload/forschung/medienpsychologie/james/2023/JAMESfocus_Nachhaltigkeit_Bericht_D.pdf

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# Module: 6322290
# Project-related geovisualization VI (deep sea VR)

## Module profile

**Exam number**
6322290

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Project

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Stefan Sauer

**Lecturer(s)**
Stefan Sauer

| | |
|---|---|
| **Applicability** | BIN, BWI, BISD, BDGD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
An interest in games
Experience with Unreal
Creating small VR applications
Basic experience with Blender or 3ds Max

**Content**
In Project-Based Geovisualisation VI, a deep-sea scenario is being developed using the Unreal game engine, with the aim of exploring the scenario from inside a submersible in the MAVEL multi-projection VR laboratory.
The focus is on independent project work using Unreal, 3ds Max and Blender in the areas of modelling, animation, shaders, scripting, particle systems, rendering and project management.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
By taking part in this module, students will be able to examine and apply selected topics from the field of geovisualisation using practical examples and exercises, thereby broadening and deepening their knowledge. Participants will be able to assess, evaluate and compare the results of their practical work, and present them in a manner tailored to specific topics and target audiences.

**Literature**
varies depending on the project

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# Module: 5003170
# Project Management and Strategic Management

## Module profile

**Exam number**
5003170

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Eva Wedlich

**Lecturer(s)**
Prof. Dr. Eva Wedlich,
Manuela Ziegler

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
'IT Project Management' or 'Project Management' and 'Fundamentals of Economics' or 'Fundamentals of Business Administration'

**Content**
This course consists of a two-day 'Project Management' simulation (SysTeams by RIVA) and a two-day 'Strategic Management' simulation (Global Strategy).
Structure:
I. Introduction to FWPM (organisational aspects),

II. Part 1: Block session on 'Project Management'

Content: Project management simulation game 'SysTeamsProject' by Riva.
The simulation game simulates a project management process from initial contact with the client through to the successful completion of the project. Working in small teams, participants define, plan and manage the project, and also implement it themselves. Numerous project management tools are available to aid effective planning, e.g.:

- Objectives plan
- Project structure plan
- Milestone plan
- Gantt chart
- Project reports
- Risk analyses

The project is divided into several phases, during which participants must tackle various project management tasks and work packages whilst taking available resources into account.

III. Introduction to 'Strategic Management'

IV. Part 2: Block course 'Strategic Management'

Content: Global Strategy is an intensive general management simulation. Over the course of several rounds, participants develop a strategy for the success of their company. The importance of strategic management for business success and the interrelationships within business administration are recognised and understood.

Content and programme:

- Profit and loss account, balance sheet

- Corporate and liquidity planning
- Costing
- Contribution margin analysis
- Cost management
- Break-even analysis
- Financing
- Marketing
- Investment analysis
- Balanced scorecard
- SWOT analysis
- Value-based corporate management
- Investment analysis
- Balanced scorecard
- SWOT analysis
- Value-based corporate management

V. Review

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**

- Students understand the principles and methods required for the effective planning and execution of projects, as well as for the management of a

business.

- Students apply the knowledge they have learnt in realistic, simulated projects in order to gain practical experience.
- Students analyse the results of each phase of the project and each financial year to identify strengths and weaknesses.
- Students evaluate the effectiveness of the strategies implemented in project management and business management on the basis of the

simulation results.

- Students develop new strategies for future simulation periods, based on the insights gained from previous phases.
- Students reflect on their experiences in the business simulation games in order to set personal and team-related learning objectives for future challenges.

**Literature**
The workbook and supplementary reading material will be provided during the course.

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# Module: 5003871
# CANVA – Smart Design: Corporate Identity & Corporate Design with AI

## Module profile

**Exam number**
5003871

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Christina Völkl-Wolf

**Lecturer(s)**
Verena Rempel

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
no restriction

**Recommended prerequisites for the participation in the module**
Your own laptop, installation of the Pro version or trial account of the CANVA programme.

**Content**
This FWPM guides you step by step from the basics to the finished design in Canva. The FWPM is aimed at students with no prior design experience who are looking to get started in the world of visual branding.

Students will learn how to use
the design software CANVA confidently in the following areas: Creating social media content
Branding and brand management, colour management and colour theory, typefaces and typography, photo editing, graphics, video, Reels, Stories, and the creation of digital and print media such as leaflets, job applications, CVs, business cards, posters, presentations, websites and much more, including with the help of Canva's own AI tools.

Content:

1. Corporate Identity – Strategic
Understanding terminology
CI, CD, brand
Best practice examples from various industries, analysis of international brands
Positioning, brand values
Mission & vision
Identity models (e.g. Golden Circle)
Target audience profile (e.g. persona)
Brand personality (mood board, archetype)
Tone and writing style

2. Corporate Design – Visual
Deriving a design system
From brand essence to visual system (designing with Canva)
Logo, colour palette, typography, visual language
Layout principles (grid, white space, composition)

3. Brand Development
Creating social media content for the brand

Colour management and the impact of colour
Fonts and typography
Photo editing, graphics
Video, Reels, Stories

Developing a brand ecosystem:
Creating digital and print media such as websites, social media content, audiovisual content, business cards, etc.

Use cases / Applications:
Self-employment/freelancing: A consistent corporate identity helps create a professional public image and sets you apart.
Portfolio: Having your own branding as a ‘common thread’ creates recognition and demonstrates strategic thinking.
Start-ups & student initiatives: A clear brand identity simplifies communication, fundraising and community building.
Agency work: CI/CD expertise is a key qualification for strategic design processes carried out on behalf of clients.
Research & academia: Academic projects also benefit from a coherent, comprehensible public image.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
Attendance is compulsory.

**Learning outcomes**
The aim is to design a consistent, professional brand identity for subsequent real-world application.

Upon successful completion of the course, students will be able to:

Students will recall key concepts of corporate identity and corporate design.
Students understand the importance of strategic brand management for digital communication media.
Students analyse CI/CD systems with regard to target audiences, differentiation and media usage.
Students evaluate design solutions in the context of user experience, media formats and communication objectives.
Students apply the knowledge they have learnt and create a comprehensive corporate identity concept, including a cross-media design system, for their own or a fictional project.

**Literature**
https://www.canva.com/de_de/

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# Module: 5003826
# Social Engineering and Security Awareness

## Module profile

**Exam number**
5003826

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar-style instruction

**Language of instruction**
English

## Organisation

**Responsible lecturer**
Prof. Dr. Kristin Weber

**Lecturer(s)**
Prof. Dr. Kristin Weber,
David Henkelmann

| | |
|---|---|
| **Applicability** | BEC, BWI, BIN |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The module 'Social Engineering and Security Awareness' focuses on the human factor in information security. People play a decisive role in information security within organisations through their behaviour – they are a key security factor. Owing to their influence, they are increasingly targeted by cybercriminals. The module examines the human factor in information security in general and two aspects in particular: the security factor and the victim.

The Human Factor in Information Security:
- The roles of humans in information security
- Insider threats
- Reasons for non-compliant behaviour

Information security awareness refers to the process of raising employees' awareness of information security (security factor):
- Security awareness concepts and models
- Psychological understanding of awareness
- Practical examples of awareness measures
- Promoting and measuring security awareness – turning employees into security factors
- Security awareness maturity models

Social engineering is the targeted manipulation of people in order to persuade them to carry out unintentional actions (victims):
- Forms and tools of social engineering
- Psychological Tactics Used by Social Engineers
- The Social Engineering Attack Cycle, including Information Gathering
- Phishing and Phishing Simulations

The course utilises group work and interactive elements, and provides opportunities for hands-on experience (in both attacking and defending against the human factor).

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
English

**Condition for the award of credit points**
none

**Learning outcomes**
Students view people as a solution rather than a problem for information security.
They explain the role of the human factor in information security using examples.
The students are familiar with and can identify the principles of social engineering and can explain them using examples.
They can name different forms of phishing and discuss the advantages and disadvantages of phishing simulations.
They understand what information security awareness means and know methods for enhancing the various aspects of awareness.
Students can develop awareness measures in a targeted and personalised manner.

**Literature**
Beißel, S.: Security Awareness, De Gruyter, 2019.
Cialdini, R.: Influence – The Psychology of Persuasion, Collins Business, 2007.
Hadnagy, C. (with Schulman, S.): Human Hacking – Win Friends, Influence People, and Leave Them Better off for Having Met You, Harper Business, 2021.
Helisch, M.; Pokoyski, D. (eds.): Security Awareness – New Approaches to Successful Employee Awareness, Vieweg+Teubner, 2010.
Schroeder, J.: Advanced Persistent Training, Apress, 2017.
Verplanken, B. (Ed.): The Psychology of Habit – Theory, Mechanisms, Change, and Context, Springer, 2018.
Weber, K.: People and Information Security, Hanser, 2024.
Weber, K.; Schütz, A.; Fertig, T.: Fundamentals and Applications of Information Security Awareness, SpringerVieweg, 2019.
Take Aware Sec&Life Magazine, https://www.take-aware-events.com/news-post/magazinesecandlife

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# Module: 5003875
# Teampsychology with KI

## Module profile

**Exam number**
5003875

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Christina Völkl-Wolf

**Lecturer(s)**
Urs Merkel

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
In the Data-Driven Team Psychology module, students learn how to collect, analyse and interpret psychometric data points using a data-driven approach. Through People Interaction Mining, both formal and informal data sources are utilised to reveal information flows, decision-making processes and group dynamics.
A key focus is on informal social network analysis (SNA) within organisations, which serves as the basis for designing agile teams – both physical and digital – in a data-driven manner. Students explore People Intelligence, a combination of Business Intelligence and People Analytics, to manage transformation processes within groups. Furthermore, they develop the ability to recognise psychometric patterns, analyse group dynamics in a targeted manner, and plan and implement data-driven interventions to enhance team performance.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- systematically identify psychological and sociological dimensions and facets using data,
- apply methods of social network analysis and people interaction mining to group processes using suitable (open-source) software,
- to apply People Intelligence – as a combination of Business Intelligence and People Analytics – to steer data-driven transformation processes within teams,
- to analyse and understand psychometric group dynamics in agile teams and to influence them in a targeted manner through data-driven interventions,
- to evaluate the effectiveness of interventions by measuring effect sizes and to feed this back into team management.

**Literature**
Borgatti, S. P.; Everett, M. G.; Johnson, J. C. (2018): Analysing Social Networks. 2nd edition. SAGE Publications, London.
Pentland, A. (2014): Social Physics: How Social Networks Can Make Us Smarter. Penguin Press, New York.
Pease, A.; Pease, B. (2016): The Definitive Book of Body Language. Bantam, London.
McAfee, A.; Brynjolfsson, E. (2017): Machine, Platform, Crowd: Harnessing Our Digital Future. W. W. Norton & Company, New York.
Up-to-date academic articles and documentation will be announced during the course.

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# Module: 5003109
# Data Protection - Technical Aspects

## Module profile

**Exam number**
5003109

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Kristin Weber

**Lecturer(s)**
Prof. Dr. Alexander Schinner, Christian Wolff

| | |
|---|---|
| **Applicability** | BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
Based on an overview of the current legal framework governing the protection of personal data and the definitions of informational self-determination and privacy, the course discusses in detail the fundamental types of protection concepts, along with the relevant technologies and protective measures applicable in each case.
The following key topics are covered:

- Fundamental protection and assurance objectives in the field of information security and data protection
- Technical and organisational measures for implementing the objectives/requirements
- Measures for access control
- Data protection-related functions on mobile devices
- Security and data protection in cloud computing and big data analytics
- Specific privacy-preserving technologies

The second part covers technical aspects of data and system protection. The aim of the course is to examine attacks on data from various perspectives. These include, amongst others, the perspective of those who wish to store data securely, those who wish to detect or investigate attacks, as well as the perspective of the attacker themselves.
The course covers the following core topics:

- Cyber Kill Chain and MITRA Att&ck Framework
- Cryptography
- Steganography
- Attacks on cryptography
- Quantum key exchange
- Authentication
- Passwords
- Zero-knowledge proofs
- Attacks
- Blockchain
- Fundamentals
- Attacks
- NFTs
- Ordinals
- Forensics

- Fundamentals
- Evidence preservation
- Carving

Practical demonstrations on the topics of incident response and cryptography will complement the event.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
The learning objective of this module is to teach the fundamental requirements of data protection in Germany and the resulting measures in the field of information security and the protection of personal data. The focus is on technical aspects.
Upon successful completion of the module, students will be able to:

- understand terms such as 'information security', 'data protection', 'informational self-determination', 'privacy' and 'anonymity', and distinguish between them
- to analyse legal and normative requirements with regard to the protection and assurance objectives they contain, and to apply them to a given context
- to derive technical and organisational measures from these requirements, assessing their suitability for implementing protection and assurance objectives and evaluating their protective effect
- To be familiar with and understand the functioning of fundamental technologies and procedures in the field of information security and data protection (e.g. procedures relating to anonymisation, encryption, authentication, communication security, incident detection and response, and security testing), including the associated potential vulnerabilities and attack vectors
- To develop a protection concept for a given scenario or application context (e.g. protecting the data of a website or an end device) in which these measures are implemented

**Literature**
Bibliography:
Eckert, Claudia: IT Security: Concepts – Methods – Protocols, Oldenbourg Wissenschaftsverlag, 10th ed., 2018
Schwenk, Jörg: Security and Cryptography on the Internet: From Secure Email to IP Encryption, Vieweg+Teubner Verlag, 4th ed., 2014
Schneier, Bruce: Secrets & Lies: IT Security in a Networked World, dpunkt.verlag/Wiley, 2001
Blog: http://www.schneier.com

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# Module: 5003872
# Topics of Socioinformatics

## Module profile

**Exam number**
5003872

**Duration**
1 semester

**Frequency**
Irregular

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Markus Oermann

**Lecturer(s)**
Prof. Dr. Markus Oermann

| | |
|---|---|
| **Applicability** | BISD, BWI, BIN |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Successful completion of the module ‘Introduction to Socioinformatics’

**Content**
The module ‘Topics in Socioinformatics’ is designed to provide in-depth practice in the skills required for the analysis of socio-technical digital systems, using current examples and discourses. To this end, the content of this module is adapted each year to reflect the latest social and academic discourses on the topic of digitalisation. At the start of the semester, participants determine the selection of discourses to be examined in consultation with the lecturer. To this end, participants map out the landscape of available sources on current topics in socio-informatics and the digital society, and then evaluate these to identify which topics are currently shaping the discourse. Building on this, the participants make a selection in consultation with the lecturer. Working independently in small groups, the participants develop the background knowledge for a discourse of their choice, identifying the key concepts, the issues under discussion and specific examples of application. The results of this group work are presented and discussed in the seminar. They also serve as the basis for the assessment (portfolio).

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
Students

- gain an overview of the discourse surrounding current topics in socio-informatics and the digital society.
- expand their personal repertoire of sources for reliable information on these topics.
- gain in-depth knowledge, based on the topics they have studied, of the issues, key concepts and societal challenges associated with the digital transformation, whilst at the same time developing their skills in analysing socio-informatics systems.
- evaluate at least one socio-technical system using a small-group-based methodological approach, thereby deepening key skills for the remainder of their degree programme, such as for project work in the 6th semester.

**Literature**
Zweig, Katharina A./Krafft, Tobias D./Klingel, Anita/Park, Enno (2021): Socioinformatics: A New Perspective on Computer Science and Society, (1st ed.). Carl Hanser, Munich.
Nassehi, Armin (2019): Patterns: A Theory of the Digital Society (2nd ed.). C.H. Beck, Munich.

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# Module: 5003876
# General Management

## Module profile

**Exam number**
5003876

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr.-Ing. Anne Heß

**Lecturer(s)**
Patrick Kalisch

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BDGD, BISD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**
The Business Management module focuses on the following key topics:

1. Understanding the fundamentals of business management
- The concept and functions of business management
- Distinguishing between management, leadership and organisation
- The role of business management within the overall organisational system
- Corporate objective systems: economic, social and environmental objectives
- Corporate management as a process of decision-making, control and coordination

2. Understanding and applying corporate objectives and objective systems
- Types of objectives: substantive objectives, formal objectives and secondary/sub-objectives
- Goal hierarchies and conflicting goals
- Goal-setting within the organisation
- Operationalisation and measurability of goals
- Key performance indicator-based goal management

3. Understanding and applying strategic corporate management
- The concept of strategy and strategic thinking
- Analysis of the external environment and the organisation
- Competitive strategies
- Growth, differentiation and cost strategies
- Strategy development, implementation and monitoring

4. Understanding and applying business management analytical tools
- SWOT analysis
- PESTEL analysis
- Industry analysis and competitive analysis
- Portfolio approaches
- Use of key performance indicators and management tools to support decision-making

5. Understanding organisational design and organisational structure

- Basic principles of organisation
- Functional, procedural and process organisation
- Forms of organisation: functional, divisional, matrix, project and process organisation
- Advantages and disadvantages of different organisational structures
- The influence of organisational structure on leadership and communication

6. Understanding leadership styles, leadership behaviour and motivation
- The concept of leadership and leadership tasks
- Classical and modern leadership styles
- Leadership behaviour in different business contexts
- Motivation theories, e.g. Maslow, Herzberg, Vroom
- Leading staff, delegation and feedback

7. Understanding and applying decision-making and problem-solving in management
- Decision-making processes and decision-making logic
- Rational versus intuitive decision-making
- Methods of problem analysis and creativity techniques
- Risks, uncertainty and decision quality

8. Understanding change management and organisational development
- Causes and triggers of change processes
- Phases of change processes
- Resistance to change
- Methods of organisational development

9. Understanding sustainable business management and corporate governance
- Sustainability as a management principle
- ESG criteria and social responsibility
- Corporate Social Responsibility (CSR)
- Good governance, compliance and ethical leadership
- Dealing with stakeholders and long-term value creation

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
1. Fundamentals of Business Management
Students can explain the fundamental tasks, concepts and objectives of business management and contextualise their significance for the management of organisations.

2. Business Objectives and Objective Systems
Students can analyse different types of objectives and conflicts of objectives, as well as develop and evaluate systems of objectives for organisations.

3. Strategic Business Management
Students can describe and contextualise strategic approaches, competitive strategies and the process of strategy development and implementation.

4. Analytical Tools in Business Management
Students can apply common analytical tools such as SWOT or PESTEL and utilise their findings to inform strategic decisions.

5. Organisational Design and Structure
Students can compare and evaluate organisational forms and structures, and apply them to practical business situations.

6. Leadership Styles, Leadership Behaviour and Motivation
Students can explain leadership styles and motivation theories and derive measures for effective staff management.

7. Controlling and Business Management
Students can explain the functions of controlling and apply basic tools for the planning, monitoring and management of businesses.

8. Change Management and Organisational Development
Students can identify change processes, resistance and success factors in change management and derive appropriate measures.

9. Sustainable Business Management and Corporate Governance
Students can assess sustainable, ethical and governance-related aspects of business management and apply them to operational decisions.

**Literature**
To be announced during the course.

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# Module: 5005202
# Business Process Management

## Module profile

**Exam number**
5005202

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Gabriele Saueressig

**Lecturer(s)**
Prof. Dr. Gabriele Saueressig,
Elias Heck

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
Course: Practical module; 120 ECTS credits

**Recommended prerequisites for the participation in the module**
Business Technologies

**Content**
Phases of the BPM cycle
Strategic BPM
- The relationship between business objectives, strategy and processes
- Approaches to strategic BPM
- Maturity models
- The evolution of process management

Operational BPM
- Business process modelling and implementation
- Process organisation
- Process controlling
- Systems to support process management (Business Process Management Systems: BPMS)
- Process mining
- Robotic Process Automation (RPA)
- Enterprise architectures for BPM (Enterprise Architecture Management, Service-Oriented Architecture, Microservices, etc.)

Practical exercise on modelling and automating end-to-end processes using an established BPM tool
Guest lectures and workshops with industry partners on various topics

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students deepen their specialist knowledge of business process management. They develop the ability to analyse and structure practical tasks in business process management.
Intended learning outcomes:

- Develop an understanding of the basic paradigm of BPM
- Understand the interrelationships between strategic and operational BPM
- Evaluate different approaches to strategic process management
- Gain knowledge of BPM standards and learn to apply process description languages, in particular BPMN 2.0
- Characterise BPM-relevant IT architectures
- Gain experience in the modelling and practical implementation of executable business processes
- Distinguish between different approaches to process controlling
- Acquire knowledge and practical experience with innovative BPM applications (e.g. process automation, process mining, robotic process automation)

**Literature**
Aalst, Wil van der: Process Mining Handbook, Springer 2022.
Allweyer, T.: BPMN 2.0 – Business Process Model and Notation: An Introduction to the Standard for Business Process Modelling, 2nd ed., 2020.
EABPM (ed.): “BPM CBOK Version 4.0: Guide to the Business Process Management Common Body of Knowledge”, 2019.
Dumas, M., et al.: “Fundamentals of Business Process Management”, Springer Vieweg 2021.
Freund, J., Rücker, B.: “Practical Handbook on BPMN: Including an Introduction to DMN”, 7th updated ed., Hanser 2025.
Gadatsch, A.: “Introductory Course in Business Process Management: Analysis, Modelling, Optimisation and Control of Processes”, 11th ed., Vieweg 2025.
Hanschke, I., Lorenz, R.: “Strategic Process Management – Simple and Effective: A Practical Guide”, 2nd updated and expanded edition, Hanser 2021.
Müller, A., Schröder, H., von Thienen, L.: “Digineering: Business Process Management in the Digital Age”, Springer Vieweg 2021.
Reinkemeyer, L. (ed.): “Process Intelligence in Action: Taking Process Mining to the Next Level”, Springer Nature 2024.
Reinkemeyer, L. (ed.): “Process Mining in Action: Principles, Use Cases and Outlook”, Springer Nature 2020.

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# Module: 5007212
# Mobile and Ubiquitous Design

## Module profile

**Exam number**
5007212

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Karsten Huffstadt

**Lecturer(s)**
Prof. Dr. Karsten Huffstadt

| | |
|---|---|
| **Applicability** | BEC, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
Course: Practical module; 120 ECTS credits

**Recommended prerequisites for the participation in the module**
none

**Content**
In the Mobile and Ubiquitous Design module, students develop comprehensive skills in context-sensitive interaction design. The focus is on the design of digital products and services that adapt flexibly to mobile usage scenarios and ubiquitous environments. The user-centred design process encompasses all relevant phases – from analysing the context of use, through conception and prototyping, to systematic evaluation.

Particular emphasis is placed on the visual, functional and interactive quality of the solution: at the end of the module, students create a fully clickable high-fidelity prototype that realistically simulates key interactions, interface logic and design elements. This is developed using the Figma design tool and embedded within a structured, professionally designed design booklet, which documents the usage scenario, the rationale behind the design decisions and reflections on the development process. This results in design-driven, practice-relevant solutions that are both compelling in terms of content and suitable for presentation.

Specific topics covered include:
- Design principles for mobile and ubiquitous systems
- Context-sensitive interaction design (location, time, movement, environment)
- Methods of human-centred and participatory design
- UX/UI design for mobile contexts (touch, voice, responsive design)
- Wireframing, low-fidelity and high-fidelity prototyping with Figma
- Design and construction of interactive clickable prototypes
- Usability testing, user testing and feedback integration
- Documentation and visualisation of design processes (structure, style, reasoning)
- Design ethics, accessibility and data protection in ubiquitous systems
- Project work: concept development, prototyping and design brochure

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Practical study achievement

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- identify key terms, interaction patterns and technologies relating to mobile and ubiquitous systems (to remember)
- explain the specific characteristics of mobile usage contexts and their influence on design decisions (to understand)
- to apply user-centred methods (e.g. personas, scenarios, customer journeys, wireframes) in a targeted manner within the design process (to apply)
- to identify real-world usage scenarios and technical requirements and systematically translate them into design concepts (to analyse)
- to evaluate designed interaction solutions in terms of user-friendliness, context sensitivity, accessibility and feasibility (to evaluate)
- to develop context-sensitive application concepts, implement them as high-fidelity prototypes using Figma, and document them professionally in a design brochure (to create)

**Literature**
Rogers, Y., Sharp, H., & Preece, J. (2023). Interaction Design: Beyond Human-Computer Interaction. Wiley
Schmidt, A., & Kranz, M. (2017). Mobile Interaction. Oldenbourg
Norman, D. A. (2013). The Design of Everyday Things. Basic Books
Buxton, B. (2007). Sketching User Experiences. Morgan Kaufmann
Kuutti, K., & Bannon, L. (2014). The turn to practice in HCI: towards a research agenda. In CHI '14
Figma Design Tool: https://www.figma.com

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# Module: 5004202
# Tools for Business Software

## Module profile

**Exam number**
5004202

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Frank Hennermann

**Lecturer(s)**
Prof. Dr. Frank Hennermann

| | |
|---|---|
| **Applicability** | BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | Concentration module |

**Required prerequisites for the participation in the module according to the SPO**
Course: Practical module; 120 ECTS credits

**Recommended prerequisites for the participation in the module**
Business Software, Advanced Course in Business Software 1: Processes, Advanced Seminar in Business Software

**Content**
This module teaches students various methods and tools that are typically applied and used in SAP implementation projects. The focus is on conceptual understanding and practical exercises carried out directly within an SAP system. Furthermore, students are expected to understand how modern AI assistants can be utilised effectively in the various phases of an SAP project in the future.

The main topics cover the following areas, though additional topics may be included on an ad hoc basis.

- Authorisation concept: Authorisation objects, authorisations, profile generator: single roles, composite roles and profiles, user master records
- Customising: selected Customising functions (document types, number ranges, screen control, field selection, status management, partner determination, etc.)
- Listing tools: Quick Viewer, queries
- SAP Activate methodology for implementing SAP solutions.
- System extension using the Clean-Core approach and the Business Technology Platform (BTP)
- Data migration
- Test automation

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Students are familiar with the SAP Activate methodology for implementing SAP solutions.
Students can design a typical presentation for client workshops and bring it to life using modern AI assistants; they can also present the content to relevant stakeholders.
Students can explain the SAP authorisation concept and the various user types. They can develop their own roles and authorisation profiles, apply them using their own user master records, and analyse the results.
Students are aware of the triggers and objectives of Customising. They develop their own strategies for given initial scenarios, can configure the necessary Customising settings, analyse the results achieved and, where necessary, correct errors.
Students are familiar with various options for extending or customising an SAP solution, e.g. via the BTP platform.
Students can use the SAP Quickviewer to generate lists, interpret the automatically generated ABAP code and test the results, as well as create their own analyses using suitable AI assistants.

**Literature**
SAP Authorisation Management, ISBN 978-3-8362-3768-0
Authorisations in SAP S/4HANA and SAP Fiori, ISBN 978-3-8362-9334-1
Materials Management with SAP S/4HANA – Customising, ISBN 978-3-367-11054-4
Production Planning and Control with SAP S/4HANA – Customising, ISBN 978-3-367-10203-7
SAP Activate: Project Management for SAP S/4HANA Cloud and SAP S/4HANA, ISBN 978-3-367-10712-4
SAP Business Technology Platform: Implementation, Services, Concepts, ISBN 978-3-367-10055-2

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# Module: 5003873
# From Software Craftsmanship to AI-powered software

## Module profile

**Exam number**
5003873

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German/English

## Organisation

**Responsible lecturer**
Prof. Dr. Peter Braun

**Lecturer(s)**
Prof. Dr. Peter Braun,
Prof. Dr. Isabel John,
Prof. Dr.-Ing. Tobias Fertig,
Christine Zilker

| | |
|---|---|
| **Applicability** | BIN, BWI, BEC, BISD, BDGD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
Modules on Programming and Software Engineering

**Content**
The module examines professional software development as an evolutionary path from traditional craftsmanship principles towards AI-supported development processes. In each thematic block, the historical foundations are first explored, such as software craftsmanship, clean code, *The Pragmatic Programmer*, complexity management, module design, and deep and shallow modules. This is followed by a discussion of the relevance these concepts will retain in a future where AI assistants generate, refactor and test code, and prepare design decisions. Students learn to critically evaluate tried-and-tested principles and apply them to modern tools such as prompt engineering, agentic coding and AI-assisted development. Guest contributions from industry highlight current and future application scenarios.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Multimedia presentation

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German/English

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- Describe key concepts and principles of software craftsmanship, clean code, pragmatic software development and AI-assisted development.
- Explain the historical evolution of professional software development, from traditional craftsmanship practices to AI-assisted development processes.
- Apply software design principles such as complexity management, modularisation, and deep and flat modules to specific code and architectural examples.
- Analyse recommendations from *Clean Code*, *The Pragmatic Programmer* and *Software Craftsmanship* in terms of their viability, limitations and context-dependence.
- Evaluate AI-assisted development practices such as prompt engineering, code generation, refactoring support, test generation and agentic coding in terms of their risk-benefit profiles.
- Apply classic development principles to the use of AI assistants to enable better prompts, reviews, tests and design decisions.
- Develop your own approaches to professional AI-assisted software development that take into account quality standards, traceability, accountability and the critical review of generated artefacts.

**Literature**

- Ousterhout, John. A Philosophy of Software Design. 2nd ed., Yaknyam Press, 2021.
- Hunt, Andrew, and David Thomas. The Pragmatic Programmer: Your Journey to Mastery. 20th Anniversary Edition, Addison-Wesley, 2019.
- Mancuso, Sandro. *The Software Craftsman: Professionalism, Pragmatism, Pride*. Prentice Hall, 2014.
- Martin, Robert C. *Clean Code: A Handbook of Agile Software Craftsmanship*. Prentice Hall, 2008.
- Kuhlen, Rainer. The Consequences of Information Assistants: What Does Informational Autonomy Mean, and How Can Trust in Electronic Services Be Ensured in Open Information Markets? Suhrkamp, 1999.
- Taulli, Tom. AI-Assisted Programming: Better Planning, Coding, Testing, and Deployment. O'Reilly Media, 2024.
- Kofler, Michael, Bernd Öggl, and Sebastian Springer. AI-Assisted Coding: The Practical Guide for Software Development. Rheinwerk Computing, 2025.
- Pereira, Sergio. Generative AI for Software Development. O'Reilly Media, 2025.
- Huyen, Chip. AI Engineering: Building Applications with Foundation Models. O'Reilly Media, 2025.

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# Module: 5003834
# Web-Intelligence

## Module profile

**Exam number**
5003834

**Duration**
1 semester

**Frequency**
Every winter semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 60 hrs

*Self-study: 90 hrs*

*Total: 150 hrs*

**Teaching format**
Seminar

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Rolf Schillinger

**Lecturer(s)**
Dr.-Ing. Benedikt Kämpgen

| | |
|---|---|
| **Applicability** | BEC, BIN, BWI |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
none

**Recommended prerequisites for the participation in the module**
none

**Content**

- Methods and technologies for the systematic, and as far as possible automated, collection and analysis of business-relevant information from the Internet, in particular from the World Wide Web
- Web Intelligence as a form of 'data discovery/acquisition via the web',
- to support better decision-making and
- to develop more useful web applications.
- Practical insights into the following topics:
- Data analytics (e.g. Pivot, OLAP, data warehousing, BigQuery),
- Web applications (e.g. low-code, AppSheet, MediaWiki),
- Data lakes (e.g. big data, NoSQL, cloud, SaaS, MapReduce),
- graph data (e.g. knowledge graphs, the Semantic Web, reasoning),
- Text data (e.g. natural language processing, large language models, ChatGPT),
- Internet of Things (e.g. sensors, actuators, micro:bit),
- Artificial Intelligence (e.g. machine learning, responsible AI).

Each session consists of approximately 50 per cent lecture and 50 per cent practical work.
The course content is delivered through lectures and presentations. Students are encouraged to study the literature and engage critically with the topics.
In addition to the lecturer, up to two external speakers will give talks based on practical experience.
During the practical sessions, students will, in some cases, work in groups to address specific questions and analyse real-world examples. To complete the practical sessions, students must have their own laptop or one laptop per group.
The course slides, sample solutions to the practical exercises and supplementary material are made available on the THWS e-learning platform (https://elearning.fhws.de).
A portfolio assessment will be used to award credit points. Students will be set 6–8 portfolio tasks, which they may complete in 1–3-page documents by pre-determined deadlines.

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Other exam (soP) according to §§ 26, 27 APO

**Examination - length/format**
Portfolio

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
Upon successful completion of the module, students will be able to:

- Identify suitable data sources and data on the web, and use analysis tools to compare data.
- Identify systems on the web and apply low-code systems to their own projects.
- Illustrate the challenges posed by big data and apply possible solutions.
- Identify and compare text data and graph data, and demonstrate their benefits.
- To illustrate the Internet of Things.
- To apply artificial intelligence to data on the web. To discuss further use cases for artificial intelligence on the web.

**Literature**
Jiming Liu, Ning Zhong, Yiyu Yao, and Zbigniew W. Ras. ‘The Wisdom Web: New Challenges for Web Intelligence (WI)’. *Journal of Intelligent Information Systems*. 2003.
Tom Heath and Christian Bizer. Linked Data: Evolving the Web into a Global Data Space. Vol. 1. Morgan & Claypool. 2011.
Sergey Melnik, Andrey Gubarev, Jing Jing Long, Geoffrey Romer, Shiva Shivakumar, Matt Tolton, Theo Vassilakis, Hossein Ahmadi, Dan Delorey, Slava Min, Mosha Pasumansky, and Jeff Shute. Dremel: A Decade of Interactive SQL Analysis at Web Scale. PVLDB. 2020.

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# Module: 1000010
# Web Programming

## Module profile

**Exam number**
1000010

**Duration**
1 semester

**Frequency**
Every semester

**Credit hours (SWS)**
4

**ECTS-Credits (CP)**
5.0

**Workload**
*Guided study time:*
Presence time: 0 hrs

*Self-study: 150 hrs*

*Total: 150 hrs*

**Teaching format**
Lecture

**Language of instruction**
German

## Organisation

**Responsible lecturer**
Prof. Dr. Rolf Schillinger

**Lecturer(s)**

| | |
|---|---|
| **Applicability** | BWI, BISD, BDGD |
| **Semester according to SPO** | 7. semester |
| **Type of module** | FWPM |

**Required prerequisites for the participation in the module according to the SPO**
This is a course offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20775,84,1218,2

**Recommended prerequisites for the participation in the module**
This is a programme offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20775,84,1218,2

**Content**
This is a programme offered by the Virtual University of Bavaria. Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20775,84,1218,2

## Examination

**Required prerequisites for the participation in the examination according to the SPO appendix**
none

**Examination - type**
Written exam (sP) according to § 23 APO

**Examination - length/format**
90 minutes

The concrete length/format of the examination will be determined in the study plan.

**Language of examination**
German

**Condition for the award of credit points**
none

**Learning outcomes**
This is a programme offered by the Virtual University of Bavaria.
Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20775,84,1218,2

**Literature**
This is a programme offered by the Virtual University of Bavaria.
Further information:
https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true&COURSEID=20775,84,1218,2