# Course Handbook Computer Science Master

created at 30.06.2025,10:25

# Computer Science Master - mandatory courses (overview)

| Module name (EN) | Code | SAP-P | Semester | Hours per semester week / Teaching method | ECTS | Module coordinator |
|---|---|---|---|---|---|---|
| Computability and Complexity Theory | DFI-BK | P610-0278 | 1 | 4V | 6 | Prof. Dr. Maximilian Altmeyer |
| Data Engineering | DFI-DE | P610-0286 | 2 | 3V+1U | 6 | Prof. Dr. Klaus Berberich |
| Data Science | DFI-DS | P610-0280 | 1 | 3V+1U | 6 | Prof. Dr. Klaus Berberich |
| English 1 | DFI-103 | P610-0275 | 1 | 2VU | 2 | Dr. Julia Frisch |
| English 2 | DFI-203 | P610-0283 | 2 | 2VU | 2 | Dr. Julia Frisch |
| French I | DFI-102 | P610-0276 | 1 | 4VU | 4 | Dr. Julia Frisch |
| French II | DFI-202 | P610-0282 | 2 | 4VU | 4 | Dr. Julia Frisch |
| German 1 | DFI-101 | P610-0274 | 1 | 4VU | 4 | Dr. Julia Frisch |
| German 2 | DFI-201 | P610-0281 | 2 | 4VU | 4 | Dr. Julia Frisch |
| Intercultural Management 1 | DFI-104 | P610-0277 | 1 | 2VU | 2 | Dr. Julia Frisch |
| Intercultural Management 2 | DFI-204 | P610-0284 | 2 | 2VU | 2 | Dr. Julia Frisch |
| Software Architecture | DFI-SAR | P610-0279 | 1 | 2V+2F | 6 | Prof. Dr. Markus Esch |
| Software Development Processes | DFI-SEP | P610-0554 | 2 | 3V+1P | 6 | Prof. Dr.-Ing. Martin Burger |
| Theoretical Informatics Seminar | DFI-STI | P610-0285 | 2 | 4V | 6 | Prof. Dr. Maximilian Altmeyer |

(14 modules)

# Computer Science Master - optional courses (overview)

| Module name (EN) | Code | SAP-P | Semester | Hours per semester week / Teaching method | ECTS | Module coordinator |
|---|---|---|---|---|---|---|
| Business Computing | DFI-BUC | | 2 | 2V+2U | 6 | Prof. Dr.-Ing. André Miede |
| Business Management & Consulting | DFI-BMA | P610-0270 | 1 | 2V+1U+1S | 6 | Prof. Dr.-Ing. André Miede |
| Cryptography Engineering | DFI-CE | P610-0273 | 2 | 2V+2P | 6 | Prof. Dr. Damian Weber |
| Discrete Mathematics | DFI-DM | P610-0269 | 1 | 3V+1U | 6 | Prof. Dr. Peter Birkner |
| Industrial UX Engineering | DFI-IUE | | 1 | 2V+2U | 6 | Prof. Dr.-Ing. Pascal Stoffels |
| Software Development for Communication Systems | DFI-SWKS | | 2 | 2V+2P | 6 | Prof. Dr. Reinhard Brocks |
| Software Quality Engineering | DFI-SQE | | 1 | 2V+2PA | 6 | Prof. Dr.-Ing. Martin Burger |

(7 modules)

# Computer Science Master - mandatory courses

## Computability and Complexity Theory

| |
|---|
| **Module name (EN): Computability and Complexity Theory** |
| **Degree programme:** Computer Science, Master, ASPO 01.10.2018 |
| **Module code:** DFI-BK |

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

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Oral examination

[*updated 20.12.2017*]

**Applicability / Curricular relevance:**

DFI-BK (P610-0278) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
KIM-BK (P222-0047) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 1, mandatory course
PIM-BK (P221-0048) Applied Informatics, Master, ASPO 01.10.2011 , semester 1, mandatory course
PIM-BK (P221-0048) Applied Informatics, Master, ASPO 01.10.2017 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
The students will be able to define the most important concepts from the computability and complexity theory and explain them using examples. They can understand the basic mathematical properties of hardware and software and are able to identify and apply theoretical concepts that solve practical problems. Students can explain the principal limitations to which certain problems are subject and analyze new problems with regard to these limitations.

The students can determine the complexity of problems regarding runtime and storage space and implement this knowledge to draw conclusions about the practical implementation of algorithms.

[*updated 20.12.2017*]

**Module content:**
1 Automata and languages
  * Finite and infinite automata
  * Regular expressions
  * Kleene´s recursion theorem
  * Quotient automaton
2 Computability theory
  * Turing machines
  * Church-Turing thesis
  * Generators
  * Decidability
  * Reduction
3 Complexity theory
  * Time complexity
  * NP-completeness
  * Space complexity

[*updated 24.02.2018*]

**Teaching methods/Media:**
Lecture, exercises, discussions

[*updated 20.12.2017*]

**Recommended or required reading:**
SIPSER Michael: Introduction to the theory of computation, Course Technology, 3rd edition, 2012
SAKAROVITCH Jacques: Elements of Automata Theory, Cambridge University Press, 2009

[*updated 20.12.2017*]

# Data Engineering

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-DE

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

**ECTS credits:**
6

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Written exam, Duration 120 min.

[*updated 13.10.2024*]

**Applicability / Curricular relevance:**

DFI-DE (P610-0286) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
KIM-DE (P222-0050) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 2, mandatory course
PIM-DE (P222-0050) Applied Informatics, Master, ASPO 01.10.2017 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be capable of handling large amounts of structured and unstructured data. They will know the basic structures of a (relational) database system and be familiar with implementation techniques (e. g. index structures and blocking mechanisms), as well as their benefits (e. g. query acceleration and transaction isolation). Students will be able to differentiate between transaction-oriented (OLTP) and analytical (OLAP) application scenarios. They will know the basic terms of so-called data warehouses and can express analytical information requirements in a suitable query language (e. g. SQL and MDX). Students will be familiar with basic information retrieval models (e. g. vector space model) and can apply them to sample data, in order to master unstructured data (e. g. text documents). They will be familiar with quality criteria (e. g. precision and yield) and can calculate them for the determined results. Students will be familiar with data mining methods, such as the analysis of shopping carts, as a means of gaining knowledge from data. Students will be capable of systematically determining the parameters of such procedures and critically assessing the results. Students will be familiar with the platforms available for distributed data processing, (e. g. MapReduce and Spark). They will be able to select a suitable platform for a given analytical task and implement the task using this platform.

[*updated 24.02.2018*]

**Module content:**

1. Introduction

2. Database systems
2.1 Architecture
2.2 Buffer management
2.3 Access structures
2.4 Query processing
2.5 Transaction management

3. Data warehouses
3.1 Modeling
3.2 Data integration
3.3 Query languages
3.4 Implementation aspects

4. Information retrieval
4.1 Retrieval models
4.2 Quality criteria and evaluation
4.3 Implementation aspects

5. Data mining
5.1 Classification
5.2 Clustering
5.3 Association rule learning

6. Big data
6.1 Platforms (e.g. MapReduce and Spark)
6.2 Interfaces (e.g. Pig and Hive)
6.3 Implementation of selected procedures (e.g. k-Means and PageRank)

[*updated 13.10.2024*]

**Teaching methods/Media:**
Transparencies, practical and theoretical exercises

[*updated 20.12.2017*]

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

Saake Gunter und Sattler Kai-Uwe: Databases: Implementierungstechniken, mitp Professional, 2011

Martin Kleppmann: Designing Data-Intensive Applications, O  Reilly, 2017

Garcia-Molina Hector, Widom Jennifer, Ulmman Jeffrey D.: Database Systems: The Complete Book, Pearson Education, 2013

Leskovec Jure, Rajaraman Anand und Ullman Jeffrey D.: Mining of Massive Datasets, Cambridge University Press, 2014

[*updated 13.10.2024*]

# Data Science

**Module name (EN): Data Science**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-DS

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

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Written exam, Duration 120 min.

[*updated 13.10.2024*]

**Applicability / Curricular relevance:**

DFI-DS (P610-0280) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
KIM-DS (P221-0051) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , optional course, informatics specific
PIM-DS (P221-0051) Applied Informatics, Master, ASPO 01.10.2017 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be able to use suitable methods of data analysis to

gain knowledge for decision-making in practical questions. Students will become familiar with important data analysis procedures. They will be familiar with different types of characteristics (e. g. nominal, ordinal, metric) and can preprocess data appropriately (e. g. by normalization or standardization). Students will be able to select appropriate decision-making procedures (e.g. regression or classification) for specific problems. They will be able to implement the procedures they have learned in a suitable programming language (e. g. Python) or use an available implementation. Students will be able to systematically determine the parameters of the applied methods on the basis of available data and critically assess the quality of their results. They will be able to prepare the knowledge gained from the data appropriately (e. g. in the form of visualization) in order to make it understandable for a technically trained or non-technically trained audience (e. g. decision-makers in the company).

[*updated 13.10.2024*]

**Module content:**
1. Introduction

2. Regression
2.1 Linear regression
2.2 Feature transformation
2.3 Regularization

3. Classification
3.1 Logistic regression
3.2 Decision trees
3.3 Naive Bayes
3.4 Support vector machines

4. Cluster analysis
4.1 Representative method (k-Means und k-Medoids)
4.2 Hierarchical method
4.3 Density-based method

5. 5.3 Association rule learning
5.1 Finding frequent item sets (Apriori and FP-Growth)
5.2 Determining association rules
5.3 Finding frequent sequences (GSP and PrefixSpan)
5.4 Finding frequent strings
5.5 Finding frequent subgraphs

6. Neural Networks
6.1 Perceptron
6.2 Multi-layer neural networks (MLPs)
6.3 Convolutional neural networks (CNNs)
6.4 Recurrent neural networks (RNNs)

7. Data visualization

[*updated 13.10.2024*]

**Teaching methods/Media:**
Transparencies, practical and theoretical exercises

[*updated 24.02.2018*]

**Recommended or required reading:**
Aggarwal C.: Data Mining - The Textbook, Springer, 2015

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

Kelleher J., Mac Namee B. und D"Arcy A.: Fundamentals of Machine Learning for Predictive Data Analytics, MIT Press, 2015

Provost F. und Fawcett T.: Data Science for Business, O"Reilly, 2013

Raschka S.: Machine Learning mit Python, mitp, 2017

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

[*updated 13.10.2024*]

# English 1

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-103

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

**ECTS credits:**
2

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
English

**Assessment:**
Written exam (50%) and tests (50%)
Written exam 90 min.

[*updated 08.08.2024*]

**Applicability / Curricular relevance:**

DFMEES-103 (P610-0128) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 1, mandatory course
DFI-103 (P610-0275) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
DFMME-103 (P610-0437) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
After successfully completing this module, students will:

understand adapted topic-related English-language specialist texts and product descriptions from the field of engineering science

have developed and expanded their subject-specific vocabulary and consolidated it through oral and written use

have developed strategies and methods for compiling and summarizing important information in a presentation, an experimental setup or a technical lecture in English

[*updated 08.08.2024*]

**Module content:**
In coordination with the DFHI Master´s degree programs in Electrical Engineering, Computer Science and European Construction Management, the content is based on common general and technical language requirements. The initial level is B1.

Technical language used in technical standards and instructions
Discussion of topic-related specialist texts from the entire spectrum of the subject
Corporate structure (centralized and decentralized organizations)
Reading, describing, evaluating and creating graphics and tables
Instructions and reports (test protocols, laboratory reports, test reports)
Presentations in a business context (e.g. on software, services, company portfolio)

[*updated 08.08.2024*]

**Teaching methods/Media:**

The learning content is developed in a communicative and action-oriented manner with targeted listening, reading and speaking exercises in individual, partner and group work. A subject-related presentation on the course content is obligatory.

Short written or oral reviews of learning progress are possible at any time.

[*updated 08.08.2024*]

**Recommended or required reading:**
Literature and learning materials will be provided during the course

[*updated 08.08.2024*]

# English 2

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-203

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

**ECTS credits:**
2

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
English

**Assessment:**
Written exam (50%) and tests (50%)

[*updated 29.04.2024*]

**Applicability / Curricular relevance:**

DFMEES-203 (P610-0139) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 2, mandatory course
DFI-203 (P610-0283) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
DFMME-203 (P610-0441) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
After successfully completing this module, students will be able to:
understand topic-related English-language specialist texts and product descriptions from the field of engineering science and be able to adequately reproduce their content
expand their subject-specific vocabulary as well as their knowledge of situationally appropriate language registers and consolidate both through oral and written practice
explain technical constructions and mechanisms of action using the appropriate language
write their own technical texts such as short reports, descriptions of laboratory experiments and project/product descriptions

[*updated 29.04.2024*]

**Module content:**
In coordination with the DFHI Master´s degree programs in Electrical Engineering, Computer Science and European Construction Management, the content is based on common general and technical language requirements and expands on the content covered in English 1. The initial level is therefore B1+/B2.
Technical language used in technical standards and instructions
Describing technical systems (on the basis of authentic technical texts, videos, etc.)
Describing cause and effect based on technical systems (language of cause and effect, passive voice)
Composing instructions and reports (test protocols, laboratory reports, test reports)
The changing working world (digitalization)
Presentation techniques and the structure of presentations

[*updated 29.04.2024*]

**Teaching methods/Media:**
The learning content is developed in a communicative and action-oriented manner with targeted listening, reading and speaking exercises in individual, partner and group work.
Short written or oral reviews of learning progress are possible at any time.

[*updated 29.04.2024*]

**Recommended or required reading:**

Multimedia-supported teaching and learning material to intensify teaching will be provided in the course and via Moodle.

[*updated 29.04.2024*]

# French I

**Module name (EN): French I**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-102

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

**ECTS credits:**
4

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
French

**Assessment:**
Written exam (50%) + presentation (25%) + tests (25%)

[*updated 08.01.2024*]

**Applicability / Curricular relevance:**

DFMEES-102 (P610-0127) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 1, mandatory course
DFI-102 (P610-0276) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
DFMME-102 (P610-0436) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
The module is based on level C1 of the CEFR.
After successfully completing this module, students will:
be able to understand the content of longer, demanding texts on current topics as well as engineering presentations within and outside their subject area and grasp implicit meanings.

have acquired the productive and receptive language skills required for communication in their studies and everyday life.

be able to express themselves in a clear, structured and logically comprehensible manner on current topics from science and society, write a comprehensive written paper on topics from their field of interest or specialization and give a comprehensible lecture/presentation.

be able to apply the central rules of grammar at C1 level.

will be able to implement strategies for autonomous learning in order to make their own learning process more effective and improve their own learning ability.

[*updated 08.01.2024*]

**Module content:**
Based on reading, audio and video examples on current topics of general social and subject-specific interest and with the help of selected exercises on vocabulary and grammar, students will learn strategies that will enable them to communicate confidently and fluently in the resp. foreign language.

Students:

will become familiar with different types of texts and writing styles,

will practice analyzing, summarizing and critically commenting on complex issues.

will acquire the ability to explain points of view in writing and orally, to grasp nuances of meaning and to deepen the accuracy of expression

Reading, describing, evaluating and creating graphics and tables

Instructions and reports (test protocols, laboratory reports, test reports)

Presentations in a business context (e.g. on software, services, company portfolio)

[*updated 08.01.2024*]

**Teaching methods/Media:**

The learning content is developed in a communicative and action-oriented manner with targeted listening, reading and speaking exercises in individual, partner and group work.

Students will review and deepen selected aspects of grammar in self-study with given (online) materials (on Moodle).

Multimedia-supported teaching and learning material, also online

[*updated 08.01.2024*]

**Recommended or required reading:**
Recommended literature and working materials will be announced and made available during the course.

[*updated 08.01.2024*]

# French II

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-202

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

**ECTS credits:**
4

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
French

**Assessment:**
Written exam (50%) + presentation (25%) + tests (25%)

[*updated 08.01.2024*]

**Applicability / Curricular relevance:**

DFMEES-202 (P610-0138) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 2, mandatory course
DFI-202 (P610-0282) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
DFMME-202 (P610-0440) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
The module is based on level C1 of the CEFR.
After successfully completing this module, students will:
- be able to understand more complex texts, such as scientific articles or technical literature, in French in detail and analyze them adequately,
- be able to use the relevant specialist terminology from the subject area in French in a form relevant to communication,
and competently develop communication strategies for demanding professional situations in international management and apply them accordingly,
- be able to give academic presentations in French and conduct academic discussions in the foreign language

while competently representing their points of view,
- be able to negotiate and hold technical discussions in French without any problems and communicate in the same way in general,
and write complex written reports in French in an appropriate form.

[*updated 08.01.2024*]

**Module content:**

Listening comprehension, reading comprehension, speaking, writing (work-related writing)
In addition, for example.: Professional problem solving strategies (national and international)
Presentations (work-related topics)
Grammar
Vocabulary (focus on technical terms)
Problem solving strategies for professional situations
Technical language used in technical standards and instructions
Describing technical systems (on the basis of authentic technical texts, videos, etc.)

[*updated 08.01.2024*]

**Teaching methods/Media:**

The learning content is developed in a communicative and action-oriented manner with targeted listening, reading and speaking exercises in individual, partner and group work.

Students will review and deepen selected aspects of grammar in self-study with given (online) materials (on Moodle).

Multimedia-supported teaching and learning material, also online

[*updated 08.01.2024*]

**Recommended or required reading:**
Recommended literature and working materials will be announced and made available during the course.

[*updated 08.01.2024*]

# German 1

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-101

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

**ECTS credits:**
4

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Written exam (50%) and tests (50%)
Written exam 90 min.

[*updated 08.08.2024*]

**Applicability / Curricular relevance:**

DFMEES-101 (P610-0126) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 1, mandatory course
DFI-101 (P610-0274) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
DFMME-101 (P610-0435) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
The module is based on level C1 of the CEFR.
After successfully completing this module, students will:
be able to understand the content of longer, demanding texts on current topics as well as engineering presentations within and outside their subject area and grasp implicit meanings.
have acquired the productive and receptive language skills required for communication in their studies and everyday life.
be able to express themselves in a clear, structured and logically comprehensible manner on current topics from science and society, write a comprehensive written paper on topics from their field of interest or specialization and give a comprehensible lecture/presentation.
be able to apply the central rules of grammar at C1 level.
will be able to implement strategies for autonomous learning in order to make their own learning process more effective and improve their own learning ability.

[*updated 08.08.2024*]

**Module content:**
In this module, students will develop their knowledge of German as a foreign language at an advanced written language level, taking into account subject-related and intercultural aspects.

Based on reading, audio and video examples on current topics of general social and subject-specific interest and with the help of selected exercises on vocabulary and grammar, students will learn strategies that will enable them to communicate confidently and fluently in the resp. foreign language.

After successfully completing this module, students will:
have become familiar with different types of texts and writing styles,
have practiced analyzing, summarizing and critically commenting on complex issues.
have acquired the ability to explain points of view in writing and orally, to grasp nuances of meaning and to deepen the accuracy of expression
have learned selected grammatical structures such as prepositional phrases, participial constructions, noun-verb-conjunctions, passive and passive substitutes, nominalization-verbalization, connectors, modal particles and genitive attributes.

[*updated 08.08.2024*]

**Teaching methods/Media:**
The learning content is developed in a communicative and action-oriented manner with targeted listening, reading and speaking exercises in individual, partner and group work.
Students will review and deepen selected aspects of grammar in self-study with given (online) materials (on Moodle).
Multimedia-supported teaching and learning material, also online

[*updated 08.08.2024*]

**Recommended or required reading:**
Recommended literature and working materials will be announced and made available during the course.

[*updated 08.08.2024*]

# German 2

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-201

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

**ECTS credits:**
4

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Written exam (50%) and tests (50%)
Written exam 90 min.

[*updated 08.08.2024*]

**Applicability / Curricular relevance:**

DFMEES-201 (P610-0137) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 2, mandatory course
DFI-201 (P610-0281) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
DFMME-201 (P610-0439) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
The module is based on level C1 of the CEFR.
After successfully completing this module, students will:
be able to understand the content of longer, demanding texts on current topics as well as engineering presentations within and outside their subject area and grasp implicit meanings.
have acquired the productive and receptive language skills required for communication in their studies and everyday life.
be able to express themselves in a clear, structured and logically comprehensible manner on current topics from science and society, write a comprehensive written paper on topics from their field of interest or specialization and give a comprehensible lecture/presentation.
be able to apply the central rules of grammar at C1 level.
will be able to implement strategies for autonomous learning in order to make their own learning process more effective and improve their own learning ability.

[*updated 08.08.2024*]

**Module content:**
In this module, students will develop their knowledge of German as a foreign language at an advanced written language level, taking into account subject-related and intercultural aspects.

Based on reading, audio and video examples of current topics of general and subject-specific interest, as well as with the help of selected exercises on vocabulary and grammar, students will review and deepen the strategies that enable them to communicate confidently and fluently in the foreign language.

After successfully completing this module, students will:
be able to review and deepen their knowledge of different types of texts and writing styles,
have expanded their ability to analyze, summarize and critically comment on complex issues, to grasp nuances of meaning and to deepen the accuracy of expression.
have improved their knowledge of selected grammatical structures.

[*updated 08.08.2024*]

**Teaching methods/Media:**
The learning content is developed in a communicative and action-oriented manner with targeted listening, reading and speaking exercises in individual, partner and group work.
Students will review and deepen selected aspects of grammar in self-study with given (online) materials (on Moodle).
Multimedia-supported teaching and learning material, also online

[*updated 08.08.2024*]

**Recommended or required reading:**
Recommended literature and working materials will be announced and made available during the course.

[*updated 08.08.2024*]

# Intercultural Management 1

**Module name (EN): Intercultural Management 1**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-104

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

**ECTS credits:**
2

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Written exam and oral presentation (each 50%)

[*updated 15.04.2024*]

**Applicability / Curricular relevance:**

DFMEES-104 (P610-0129) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 1, mandatory course
DFI-104 (P610-0277) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
DFMME-104 (P610-0438) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
After successfully completing this module, students will be able to:
recognize communicative and (work) cultural causes for problems in intercultural situations
reflect on their own cultural imprint, especially with regard to communication behavior and (work) behavior in teams
develop solution strategies for challenges in multicultural work contexts
understand the work-cultural and communicative characteristics of the Arab world and can compare these to their own expectations of communication and work situations

[*updated 15.04.2024*]

**Module content:**
Consolidation of basic concepts and models from the subject areas of culture, communication and perception of others (alignment of students´ previous knowledge)
Conflict behavior and solution strategies in an intercultural work context (teamwork, hierarchies, understanding work and roles, metacommunication)
Cultural (self-)awareness as a key competence
Case studies and practical exercises
Non-European focus: the Arab world

[*updated 15.04.2024*]

**Teaching methods/Media:**
Lecturer presentations
(Interactive) exercises and case studies
Group work
Digital content via moodle

[*updated 15.04.2024*]

**Recommended or required reading:**
Will be announced in the course
Multimedia-supported teaching and learning material to intensify teaching will be provided in the course and via Moodle.

[*updated 15.04.2024*]

# Intercultural Management 2

**Module name (EN): Intercultural Management 2**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-204

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

**ECTS credits:**
2

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Written exam and oral presentation (each 50%)

[*updated 15.04.2024*]

**Applicability / Curricular relevance:**

DFMEES-204 (P610-0096) Electrical Engineering - Renewable Energy and System Technology, Master, ASPO 01.10.2019 , semester 2, mandatory course
DFI-204 (P610-0284) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
DFMME-204 (P610-0442) Mechanical Engineering, Master, ASPO 01.10.2024 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Dr. Julia Frisch

**Lecturer:**
Dozierende des Studiengangs

[*updated 29.04.2025*]

**Learning outcomes:**
After successfully completing this module, students will be able to:

weigh up different models of intercultural competence(s) against each other
explain strategies for acquiring intercultural competence(s)
work on smaller intercultural training units as part of a simulation/management game
discuss the Euro/US-centric perspective of various common studies and models in the field of intercultural business communication

[*updated 15.04.2024*]

**Module content:**
Constructive intercultural management
Intercultural learning and intercultural forms of training
Change of perspective: working with multicultural colleagues and team members in the company or within their own projects
Opportunities, limits and risks of comparative cultural models in everyday working life
Case studies and practical exercises
Possible focuses: Europe outside of Germany and France, USA

[*updated 15.04.2024*]

**Teaching methods/Media:**
Lecturer presentations
(Interactive) exercises and case studies
Group work
Digital content via moodle

[*updated 15.04.2024*]

**Recommended or required reading:**
Will be announced in the course

Multimedia-supported teaching and learning material to intensify teaching will be provided in the course and via Moodle.

[*updated 15.04.2024*]

# Software Architecture

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-SAR

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

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Project

[*updated 20.12.2017*]

**Applicability / Curricular relevance:**

DFI-SAR (P610-0279) Computer Science, Master, ASPO 01.10.2018 , semester 1, mandatory course
KI747 Computer Science and Communication Systems, Master, ASPO 01.04.2016 , semester 1, optional course, informatics specific
KIM-SAR (P221-0059) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 1, optional course
PIM-SAR (P221-0059) Applied Informatics, Master, ASPO 01.10.2011 , semester 1, mandatory course
PIM-SAR (P221-0059) Applied Informatics, Master, ASPO 01.10.2017 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Prof. Dr. Markus Esch

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be capable of naming the basic concepts and methods of software architecture. They will be able to describe the tasks and role of a software architect in a project team and understand the importance of software architecture in large software projects.

They will be capable of deriving properties of a software architecture from user requirements and of developing and documenting a design using modern architectural approaches. In addition, they will also be able to analyze the advantages and disadvantages of an architecture and derive potential for improvement.

In the case studies accompanying the lectures, students will learn to work independently in small groups. They will be able to present their results and to document them in the form of a scientific publication.

[*updated 24.02.2018*]

**Module content:**
- Requirements for a software architecture
- The role and tasks of a software architect
- Process models
- Architectural views
- Architecture styles and patterns
- The documentation of a software architecture

[*updated 20.12.2017*]

**Teaching methods/Media:**
Lecture slides, annotated lecture slides as a script

[*updated 20.12.2017*]

**Recommended or required reading:**
Len BASS, Rick KAZMAN, Paul CLEMENTS: Software Architecture in Practice, Addison Wesley, 3rd Edition 2012

Gernot STARKE: Effektive Softwarearchitekturen: Ein praktischer Leitfaden, Hanser Verlag, 7. Auflage, 2015

Stefan ZÖRNER: Softwarearchitekturen dokumentieren und kommunizieren: Entwürfe, Entscheidungen und Lösungen nachvollziehbar und wirkungsvoll festhalten, Hanser Verlag, 2. Auflage, 2015

Rick KAZMAN, Humberto CERVANTES: Designing Software Architectures - A Practical Approach, Addison Wesley, 2016

George FAIRBANKS: Just Enough Software Architecture: A Risk-Driven Approach, Marshall & Brainerd, 2010

[*updated 30.07.2021*]

# Software Development Processes

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-SEP

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

**ECTS credits:**
6

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Oral examination 40%, term paper 30%, presentation 30%

[*updated 24.02.2018*]

**Applicability / Curricular relevance:**

DFI-SEP (P610-0554) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
KI841 (P222-0096) Computer Science and Communication Systems, Master, ASPO 01.04.2016 , semester 2, optional course, informatics specific
KIM-SEP (P221-0060) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 2, optional course, informatics specific
PIM-SEP (P221-0060) Applied Informatics, Master, ASPO 01.10.2011 , semester 2, mandatory course
PIM-SEP (P221-0060) Applied Informatics, Master, ASPO 01.10.2017 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be able to compare stability-oriented and continuously adapting procedures.

- They will be able to differentiate between contexts in which stability-oriented and agile development processes are suitable.

- They will be able to discuss the principles of agile development processes.

- They will be able to create requirements for software systems and prioritize them.

- They will be able to plan the creation of software solutions using agile methods.

- They will be able to discuss the importance of teamwork and communication in software development.

- They will be able to work independently on agile software development topics, summarize their findings and present them.

[*updated 17.04.2025*]

**Module content:**
The focus of this module is the principles and practices of agile software development processes. Students will learn how to deliver high-quality software with high customer value in the shortest possible time using constantly adapting procedures.

Software Development Processes:

- Definition and importance of software development processes
- Comparing the waterfall model and agile development

Agile Basics und Principles:

- The agile manifesto and its values
- Agile principles and methods

Agile Requirements Management:

- Creating and prioritizing user stories
- Product and sprint backlog management

Agile Project Management:

- Sprint and release planning
- Velocity calculation and burndown charts

Team Work and Communication:

- Effective collaboration in a team
- Communication and transparency

This content is supplemented and further developed by topics presented by the students.

[*updated 30.06.2024*]

**Teaching methods/Media:**
Transparencies, projector

[*updated 24.02.2018*]

**Recommended or required reading:**
Agile Testing
Der agile Weg zur Qualität
Von Manfred Baumgartner, Martin Klonk, Christian Mastnak, Richard Seidl · 2023

Clean Agile. Die Essenz der agilen Softwareentwicklung
Zurück zu den Ursprüngen: Die agilen Werte und Prinzipien effektiv in der Praxis umsetzen
Von Robert C. Martin · 2020

Engineering Software Products
An Introduction to Modern Software Engineering
Von Ian Sommerville · 2019

Implementing Lean Software Development
From Concept to Cash
Von Mary Poppendieck, Tom Poppendieck · 2006

Modernes Software-Engineering
Entwurf und Entwicklung von Softwareprodukten
Von Ian Sommerville · 2020

Requirements Engineering für die agile Softwareentwicklung
Methoden, Techniken und Strategien
Von Johannes Bergsmann · 2023

Requirements-Engineering und -Management
Das Handbuch für Anforderungen in jeder Situation
Von Christine Rupp, SOPHISTen · 2020

Software Engineering
Von Ian Sommerville · 2018

Software Engineering, Global Edition
Von Ian Sommerville · 2016

Software Engineering
Grundlagen, Menschen, Prozesse, Techniken
Von Jochen Ludewig, Horst Lichter · 2023

Software Engineering - kompakt
Von Anja Metzner · 2020

Diese Literatur wird entsprechend den von den Studierenden präsentierten Themen ergänzt.

[*updated 30.06.2024*]

# Theoretical Informatics Seminar

**Module name (EN): Theoretical Informatics Seminar**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-STI

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

**ECTS credits:**
6

**Semester:** 2

**Mandatory course:** yes

**Language of instruction:**
German

**Assessment:**
Practice talk, talk

[*updated 24.02.2018*]

**Applicability / Curricular relevance:**

DFI-STI (P610-0285) Computer Science, Master, ASPO 01.10.2018 , semester 2, mandatory course
KI848 Computer Science and Communication Systems, Master, ASPO 01.04.2016 , semester 2, optional course, informatics specific
KIM-STI (P221-0058) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 2, optional course, informatics specific
PIM-STI (P221-0058) Applied Informatics, Master, ASPO 01.10.2011 , semester 2, mandatory course
PIM-STI (P221-0058) Applied Informatics, Master, ASPO 01.10.2017 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be able to independently analyze, prepare and present the content of a challenging scientific topic pertaining to theoretical computer science in an understandable way within a given period of time. In addition, they will be able to participate actively in a technical discussion and concisely summarize the lectures they have heard.

[*updated 24.02.2018*]

**Module content:**
Advanced topics pertaining to the computability theory, complexity theory and algorithms, e. g. probabilistic algorithms, alternating automata, zero-knowledge proofs, approximation algorithms.

[*updated 24.02.2018*]

**Teaching methods/Media:**
Practice talk, talk by student, discussion, summary by listeners

[*updated 24.02.2018*]

**Recommended or required reading:**
Berstel, Boasson, Carton, Fagnot: Minimization of automata, http://arxiv.org/abs/1010.5318
Berstel, Perrin, Reutenauer: Codes and Automata, Cambridge University Press 2010.
Cormen, Leiserson, Rivest: Introduction to Algorithms, The MIT Press 1997.
Hopcroft, Ullman: Ullman: Einführung in die Automatentheorie, Formale Sprachen und Komplexitätstheorie, Addison-Wesley, 1994.
Moore, Christopher; Mertens, Stefan: The Nature of Computation, Oxford University Press 2011.
Motwani, Rajeev; Raghavan, Prabhakar: Randomized Algorithms, Cambridge University Press 2007.
Sipser: Introduction to the Theory of Computation, Second Edition, Thomson 2006.
Vazirani, Vijay: Approximation Algorithms, Springer 2003.
and other articles

[*updated 24.02.2018*]

# Computer Science Master - optional courses

## Business Computing

**Module name (EN): Business Computing**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-BUC

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

**ECTS credits:**
6

**Semester:** 2

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Oral examination 80%, presentation 20%

[*updated 26.02.2018*]

**Applicability / Curricular relevance:**

DFI-BUC Computer Science, Master, ASPO 01.10.2018 , semester 2, optional course
KIM-BUC Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 2, optional course, informatics specific
PIM-BUC (P221-0049) Applied Informatics, Master, ASPO 01.10.2017 , semester 2, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

**Lecturer:** Prof. Dr.-Ing. André Miede

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be able to list and describe the interrelationships between a company´s organizational processes and their IT implementation. They will be able to explain the importance of coordinating and aligning both areas for the development of effective IT solutions. Lastly, students will be able to apply basic methods and tools for modelling business processes in theory and practice.

[*updated 26.02.2018*]

**Module content:**
I. Theoretical Part (also includes exercises):

1. Introduction and overview
   Processes, process management, business processes, workflows etc.
2. Process modeling
   Layers, phases, views and methods (EPC, BPMN, UML etc.)
3. Process management with standard business management software
   Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship

Management (CRM), Data Warehouse (DWH) etc.

4. Business process modeling and simulation with ARIS
   (see practical part)
5. Related IT topics
   Workflow management systems (WFMS), service-oriented architecture (SOA), cloud computing

II. Practical Part: Process design and analysis with ARIS (ARIS -- Architektur integrierter Informationssysteme)

o ARIS is a widely used tool for process management, especially the modelling and simulation of business processes. As part of the course, students will work on exercises live with ARIS (Architect, Simulator, Publisher).

o The software will be available to students free of charge on their private computers.

o The Software AG has agreed to certify the successful completion of all ARIS tasks.

[*updated 26.02.2018*]

**Recommended or required reading:**
Andreas Gadatsch: Grundkurs Geschäftsprozess-Management, Methoden Und Werkzeuge für die IT-Praxis: Eine Einführung für Studenten und Praktiker. Springer Vieweg.

Marlon Dumas; Marcello La Rosa; Jan Mendling; Hajo Reijers: Fundamentals of Business Process Management. Springer.

Jakob Freund; Bernd Rücker: Praxishandbuch BPMN 2.0. Hanser.

Heinrich Seildmeier: Prozessmodellierung mit ARIS® -- Eine beispielorientierte Einführung für Studium und Praxis. Springer.

ARIS Community: http://www.ariscommunity.com/university/students

Tim Weilkiens; Christian Weiss; Andrea Grass: Basiswissen Geschäftsprozessmanagement, Aus- und Weiterbildung zum OMG Certified Expert in Business Process Management (OCEB) -- Fundamental Level. dpunkt.verlag.

Inge Hanschke; Gunnar Giesinger; Daniel Goetze: Business Analyse -- Einfach und effektiv, Geschäftsanforderungen verstehen und in IT-Lösungen umsetzen. Hanser.

[*updated 26.02.2018*]

# Business Management & Consulting

**Module name (EN): Business Management & Consulting**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-BMA

**Hours per semester week / Teaching method:**
2V+1U+1S (4 hours per week)

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Oral examination 70%, presentation 30%

[*updated 26.02.2018*]

**Applicability / Curricular relevance:**

DFI-BMA (P610-0270) Computer Science, Master, ASPO 01.10.2018 , semester 1, optional course
PIM-BMA (P221-0050) Applied Informatics, Master, ASPO 01.10.2017 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

**Lecturer:** Prof. Dr.-Ing. André Miede

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will have acquired the knowledge and skills to name, explain and compare classical and modern management concepts in order to operate successfully in existing management structures. In addition, they will be able to name, summarize and explain the basic concepts of management consulting, in particular the competencies and methods with which companies, divisions/departments, structures/processes and the resources used there can be evaluated and further developed. In addition, students will be able to describe the strong link to IT in both areas and the resulting opportunities and challenges.

[*updated 26.02.2018*]

**Module content:**
Part I: Business management
1. Introduction and overview
2. Strategy and planning
3. Organization
4. Personnel and management
5. Controlling

6. Selected special topics related to management

Part II: Consulting
1. Introduction and overview
2. Consulting markets and sub-markets
3. Consulting acquisition
4. The consulting process
5. Methods of analysis and evaluation/design and change methods
6. Selected special topics related to consulting

[*updated 26.02.2018*]

**Recommended or required reading:**
Part I: Business management
Harald Hungenberg, Torsten Wulf: Grundlagen der Unternehmensführung, Springer.
Bernd Lieber: Personalführung, utb.
John R. Schermerhorn: Introduction to Management, Wiley.
Tom DeMarco, Timothy Lister: Peopleware, Addison-Wesley.
Tom DeMarco: Slack, Crown Business.
Jack Welch, Suzy Wetlaufer: Winning, HarperCollins.
Gunter Dueck: Professionelle Intelligenz, Eichborn.
Gunter Dueck: Lean Brain Management, Springer.

Part II: Consulting
Christel Niedereichholz: Unternehmensberatung Band 1: Beratungsmarketing und Auftragsakquisition, Oldenbourg.
Christel Niedereichholz: Unternehmensberatung Band 2: Auftragsdurchführung und Qualitätssicherung, Oldenbourg.

[*updated 26.02.2018*]

# Cryptography Engineering

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-CE

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

**ECTS credits:**
6

**Semester:** 2

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Written exam, 90 min.

[*updated 04.09.2023*]

**Applicability / Curricular relevance:**

DFI-CE (P610-0273) Computer Science, Master, ASPO 01.10.2018 , semester 2, optional course, informatics specific
KIM-CE (P221-0154) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 2, mandatory course
PIM-CE (P221-0154) Applied Informatics, Master, ASPO 01.10.2017 , semester 2, optional course, informatics specific

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Prof. Dr. Damian Weber

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be able to assess the security of symmetric, as well as public-key cryptosystems against typical types of attacks.

They will be able to configure cryptosystems, understand their implementation and point out possible weaknesses.

After a detailed analysis, they will be able to draw up a proposal to increase the security level for a given application scenario.

[*updated 04.09.2023*]

**Module content:**
1. Basics, terms and definitions
2. RSA
3. Diffie-Hellman key exchange
4. ElGamal encryption and signature scheme
5. Elliptic curve cryptography
6. Cryptographic hash functions
7. Digital signatures (RSA, DSA, ECDSA)
8. Symmetrical cryptography methods (stream ciphers, block ciphers)

[*updated 19.05.2023*]

**Recommended or required reading:**
Ferguson, Cryptography Engineering: Design Principles and Practical Applications, Wiley, 2010
Paar, Understanding Cryptography: A Textbook for Students and Practitioners, Springer, 2011
Katz, Lindell, Introduction to Modern Cryptography, 2014

[*updated 26.02.2018*]

# Discrete Mathematics

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-DM

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

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Exam

[*updated 30.06.2024*]

**Applicability / Curricular relevance:**

DFI-DM (P610-0269) Computer Science, Master, ASPO 01.10.2018 , semester 1, optional course
KI873 Computer Science and Communication Systems, Master, ASPO 01.04.2016 , semester 2, optional course, informatics specific
KIM-DM (P222-0051) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 1, mandatory course
PIM-DM (P222-0051) Applied Informatics, Master, ASPO 01.10.2011 , semester 2, mandatory course
PIM-DM (P222-0051) Applied Informatics, Master, ASPO 01.10.2017 , semester 1, mandatory course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

**Module coordinator:**
Prof. Dr. Peter Birkner

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

[*updated 09.08.2020*]

**Learning outcomes:**

After successfully completing this module, students will have improved their knowledge about the concept of divisibility in the area of whole numbers. They will be able to recognize and apply divisibility relationships. Students will have worked with the lecturer to derive the congruence relation from divisibility. They will be familiar with the concept of the remainder class and will be able to calculate its inverse. They will be able to analyze the structure of residue class groups.

Students will be familiar with the Chinese Remainder Theorem. They will be able to derive the general proof from the proof for 2 equations. They will be able to apply the Chinese Remainder Theorem to specific tasks and use it to solve practical problems.

Students will be able to explain what prime numbers are. They will be able to estimate the number of prime numbers below a given threshold. They will be able to use a primality test to check whether a natural number is prime or not. They will be able to recognize pseudoprimes and know what this means for the primality test.

They will have improved their knowledge about the group theory. They will be familiar with various properties and structures, such as order, (cyclic) subgroup, generator, etc. They will be able to recognize these structures and apply them in different contexts.

Students will be able to identify the problem of the discrete logarithm. They will be able to solve it independently using the baby-step giant-step algorithm and perform the Diffie-Hellman protocol as an application.

The students will be able to explain what an elliptic curve is and know how to add points to it. They will be able to recognize the group structure in the set of points and apply both the field theory and the Diffie-Hellman protocol to elliptic curves.

[*updated 30.06.2024*]

**Module content:**

1. Module arithmetics
Divisibility, congruences, efficient modular exponentiation mod p, divisibility rules, residue classes, inverse residue classes, residue class groups, Euler´s phi function and its calculation

2. The Chinese Remainder Theorem (CRT)
CRT for 2 equations, CRT in general, examples and applications

3. Prime numbers

Prime numbers, fundamental theorem of algebra, there are infinitely many prime numbers, prime number theorem, Fermat´s little theorem, Fermat primality test, pseudoprimes

4. Group theory
Group axioms, subgroups, exponentiation in groups, cyclic groups, ordering of elements and groups, homomorphisms, kernel and image

5. The discrete logarithm (DL)
The DL, Square and Multiply Method, Shanks Baby-Step Giant-Step Algorithm, the Diffie-Hellman-Protocol

6. Field theory
Finite bodies, characteristics

7. Elliptic curves (EC)
EC, points on the EC, Weierstrass equation, group law, graphical addition, discriminant, number of points of an EC over F_p, the Hasse-Weil interval

[*updated 30.06.2024*]

**Recommended or required reading:**

- Ziegenbalg: Elementare Zahlentheorie (Beispiele, Geschichte, Algorithmen) Springer, 2015

- Washington: Elliptic Curves (Number Theory and Cryptography), Chapman& Hall, 2008

- Iwanowski, Lang: Diskrete Mathematik mit Grundlagen (Lehrbuch für Studierende von MINT-Fächern), Springer, 2014

[*updated 30.06.2024*]

# Industrial UX Engineering

**Module name (EN): Industrial UX Engineering**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-IUE

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

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Project work

[*updated 21.10.2024*]

**Applicability / Curricular relevance:**

DFI-IUE Computer Science, Master, ASPO 01.10.2018 , semester 1, optional course
KIM-IUE (P221-0207) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 3, optional course
PIM-IUE (P221-0207) Applied Informatics, Master, ASPO 01.10.2017 , semester 3, optional course

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 30.08.2024*]

**Learning outcomes:**
After successfully completing this module, students will be able to define personas and user stories and to identify requirements from these to support employees in production.

They will be able to design and implement assistance systems for production using various technologies.

They will be able to describe the basic principles of user experience, differentiate these from related concepts such as usability and explain the user-centered design process, while also applying this knowledge to the implementation of interactive systems in a production context.

They will be able to explain and apply prototyping concepts and discuss their advantages and disadvantages.

Students will be able to explain and apply prototyping concepts and discuss their advantages and disadvantages.

[*updated 21.10.2024*]

**Module content:**

Introduction to production
Worker guidance systems (pick-by-light, pick-to-light, AR...)
Component identification technology
Human-computer interaction, user experience, usability, user-centered design process
User needs, problem statements, personas, scenarios
Prototyping methods

Evaluation of interactive systems in a production environment

[*updated 21.10.2024*]

**Recommended or required reading:**

[*updated 21.10.2024*]

# Software Development for Communication Systems

**Module name (EN): Software Development for Communication Systems**

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-SWKS

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

**ECTS credits:**
6

**Semester:** 2

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Project work

[*updated 13.11.2024*]

**Applicability / Curricular relevance:**

DFI-SWKS Computer Science, Master, ASPO 01.10.2018 , semester 2, optional course
KIM-SWKS (P222-0070) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 2, mandatory course
PIM-SWKS (P221-0191, P222-0070) Applied Informatics, Master, ASPO 01.10.2017 , semester 2, optional course, informatics specific

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
After successfully completing this module, students will be able to complete a project in the area of communication systems, even with unfamiliar software frameworks and development tools, in order to quickly familiarize themselves with a complex project in the company.

[*updated 13.11.2024*]

**Module content:**
Students will carry out a software project on a topic from the field of communication networks. As a rule, it should cover all aspects of the development process, from build management, requirement engineering, software design and implementation to testing and deployment. The project must be documented and will end with a presentation by the student.

Possible technical aspects:
* Serialization Codec implementation based on various serialization techniques (ASN.1, JSON, XML, Protobuf)
* Test automation: Unit testing, browser testing, performance measurements, load and stress testing
* Communication: REST, GraphQL, interprocess communication, client-server programming based on different transmission protocols (UDP, TCP, HTTP, MQTT), encrypted network connections, streaming
* Model-driven software development, domain-specific languages
* Single-board computers
* Network simulation
* Implementation techniques of protocol layers and state machines
* Threads / Parallel programming
* Timer
* Tracing / Logging / Monitoring
* Platform configurations, server management

[*updated 19.05.2023*]

**Teaching methods/Media:**

[*updated 13.11.2024*]

**Recommended or required reading:**
Class literature will be based on the project s context. This usually consists of online sources on the frameworks used, software development tools or textbook literature on design methods.

[*updated 19.05.2023*]

# Software Quality Engineering

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

**Degree programme:** Computer Science, Master, ASPO 01.10.2018

**Module code:** DFI-SQE

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

**ECTS credits:**
6

**Semester:** 1

**Mandatory course:** no

**Language of instruction:**
German

**Assessment:**
Project with final presentation

[*updated 20.12.2017*]

**Applicability / Curricular relevance:**

DFI-SQE Computer Science, Master, ASPO 01.10.2018 , semester 1, optional course, informatics specific
KI786 Computer Science and Communication Systems, Master, ASPO 01.04.2016 , semester 1, optional course, informatics specific
KIM-SQE (P221-0144) Computer Science and Communication Systems, Master, ASPO 01.10.2017 , semester 1, optional course, informatics specific
PIM-WI78 Applied Informatics, Master, ASPO 01.10.2011 , semester 1, optional course, informatics specific
PIM-SQE (P221-0144) Applied Informatics, Master, ASPO 01.10.2017 , semester 1, optional course, informatics specific

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

**Recommended prerequisites (modules):**
None.

**Recommended as prerequisite for:**

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

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

[*updated 09.08.2020*]

**Learning outcomes:**
In times of large IT projects on the one hand and agile software development (with shorter and shorter release cycles) on the other, the importance of software quality assurance increases.
_ After successfully completing this course, students will be able to define the most important terms and concepts in software quality engineering and explain them using examples.
_ They will know and understand the various concepts of static and dynamic test techniques and be able to apply them to actual problems.
_ Students will be able to differentiate between different types of tests and know how they are used in different test stages and how to integrate them into the test process.
_ Students will become familiar with the different requirements for quality assurance in classic and agile development models and how these can be met.
_ Students will understand how to use tools for support in different scenarios and types of tests (test organization, test automation, load and performance tests, etc.)

[*updated 24.02.2018*]

**Module content:**
1. Basics of software quality assurance and introduction to software testing
2. Basics of agility and agile testing
3. Statistic software quality measures and black box test design techniques
4. White box test design techniques and code-driven metrics
5. Test automation I (general introduction and use in the classic process model)
6. Test automation II (use in the agile process model)
7. Test management, management-driven metrics and test planning and _estimates
8. Tool support and non-functional tests I (usability, security, operational tests)
9. Non-functional tests II (load and performance tests)
10. Final exercise (group work)

[*updated 24.02.2018*]

**Teaching methods/Media:**
Slides -

The slides can be used as a script and will be made available to students. In addition, selected articles on the topics of the lecture will be recommended.

[*updated 20.12.2017*]

**Recommended or required reading:**
Andreas Spillner,Tilo Linz:
Basiswissen Softwaretest: Aus- und Weiterbildung zum Certified Tester - Foundation Level nach ISTQB-Standard (ISQL-Reihe), dPunkt Verlag

[*updated 20.12.2017*]