MODULE HANDBOOK

Bachelor of Science

Bachelor Software Development (FS-OI-BASD)

180 CP

Distance Learning

As of May 29th, 2025

INTERNATIONAL
UNIVERSITY OF
APPLIED SCIENCES

Classification: Undergraduate

Contents

1. Semester

Module IGIS_E: Software Engineering Principles
Module Description 12
Course IGIS01_E: Software Engineering Principles 14

Module DLBCSIAW: Introduction to Academic Work
Module Description 19
Course DLBCSIAW01: Introduction to Academic Work 21

Module DLBCSRE: Requirements Engineering
Module Description 26
Course DLBCSRE01: Requirements Engineering 28

Module DLBCSS: Specification
Module Description 33
Course DLBCSS01: Specification 35

Module DLBCSOOPJ: Object-oriented Programming with Java
Module Description 39
Course DLBCSOOPJ01: Object-oriented Programming with Java 41

Module DLBCSDMDS: Database Modeling and Database Systems
Module Description 46
Course DLBCSDMDS01: Database Modeling and Database Systems 48

2. Semester

Module DLBCSDSJCL: Data Structures and Java Class Library
Module Description 53
Course DLBCSDSJCL01: Data Structures and Java Class Library 55

Module DLBCSCW: Collaborative Work
Module Description 59
Course DLBCSCW01: Collaborative Work 61

Module DLBCSWAD: Web Application Development
Module Description 67
Course DLBCSWAD01: Web Application Development 69

Module DLBCSL-01: Algorithms, Data Structures, and Programming Languages
Module Description 73
Course DLBCSL01-01: Algorithms, Data Structures, and Programming Languages 75

Module DLBCSSQA: Software Quality Assurance
Module Description 80
Course DLBCSSQA01: Software Quality Assurance 82

Module IAMG_E: IT Architecture Management
Module Description 87
Course DLBCSEITPAM02: IT Architecture Management 89

---

3. Semester

Module IPWA2-01_E: Programming Information Systems with Java EE
Module Description 94
Course IPWA02-01_E: Programming Information Systems with Java EE 96

Module DLBSEPENIT_E: Ethics and Sustainability in IT
Module Description 100
Course DLBSEPENIT01_E: Ethics and Sustainability in IT 102

Module DLBCSEITPAM1: IT Project Management
Module Description 107
Course DLBCSEITPAM01: IT Project Management 109

Module IWNF1_E: Techniques and methods for agile software development
Module Description 113
Course IWNF01_E: Techniques and methods for agile software development 115

Module DLBCSEMSE1: Mobile Software Engineering
Module Description 119
Course DLBCSEMSE01: Mobile Software Engineering 121

Module ISSE_E: Seminar: Software Engineering
Module Description 126
Course ISSE01_E: Seminar: Software Engineering 128

---

4. Semester

Module IWNF2_E: Project: Agile Software Engineering
Module Description 132
Course IWNF02_E: Project: Agile Software Engineering 134

Module DLBSEPITI_E: IT Infrastructure
Module Description 136
Course DLBSEPITI01_E: IT Infrastructure 138

Module DLBCSITSM-02: IT Service Management
Module Description 141
Course DLBCSITSM01-02: IT Service Management 143

Module DLBCSEMSE2: Project: Mobile Software Engineering
Module Description 147
Course DLBCSEMSE02: Project: Mobile Software Engineering 149

Module DLBSEPCP_E: Project: Cloud Programming
Module Description 153
Course DLBSEPCP01_E: Project: Cloud Programming 155

Module DLBCSIDPITS: Introduction to Data Protection and Cyber Security
Module Description 159
Course DLBCSIDPITS01: Introduction to Data Protection and Cyber Security 161

---

5. Semester

Module DLBSEPDOCD_E: DevOps and Continuous Delivery
Module Description 166
Course DLBSEPDOCD01_E: DevOps and Continuous Delivery 168

Module DLBMIUID1_E: User Interface Design and Ergonomics
Module Description 171
Course DLBMIUID01_E: User Interface Design and Ergonomics 173

Module DLBDSIPWP: Introduction to Programming with Python
Module Description 176
Course DLBDSIPWP01: Introduction to Programming with Python 178

Module DLBSEPPSD_E: Project: Software Development
Module Description 182
Course DLBSEPPSD01_E: Project: Software Development 184

Module DLBSEWMG_E: Mathematics Basics
Module Description 187
Course DLBCSM101: Mathematics I 189
Course DLBCSM201: Mathematics II 193

Module DLBSEWMLAA_E: Mathematics: Linear Algebra and Analysis

Module Description 197
Course DLBDSMFLA01: Mathematics: Linear Algebra 199
Course DLBDSMFC01: Mathematics: Analysis 203

Module DLBSEWSG-02_E: Statistics Basics
Module Description 207
Course DLBDSSPDS01-01: Statistics: Probability and Descriptive Statistics 209
Course DLBDSSIS01-01: Statistics - Inferential Statistics 213

Module DLBSEWDSPP-01_E: Data Science and Object Oriented Programming with Python
Module Description 217
Course DLBDSIDS01-01: Introduction to Data Science 219
Course DLBDSOOFPP01: Project: Object Oriented and Functional Programming in Python 223

Module DLBSEWITES_E: Internet of Things and Embedded Systems
Module Description 227
Course DLBINGEIT01_E: Introduction to the Internet of Things 229
Course DLBROES01_E: Embedded Systems 233

Module DLBSEWRI-01_E: Robotics and Production Engineering
Module Description 237
Course DLBROIR01-01_E: Introduction to Robotics 240
Course DLBDSEAR01: Production Engineering Industry 4.0 244

Module DLBSEWIML_E: International Management and Leadership
Module Description 249
Course BWINT01: International Management 252
Course DLBWPLS01_E: Leadership 4.0 259

Module DLBDSEIMB: International Marketing and Branding
Module Description 264
Course DLBDSEIMB01: International Marketing 267
Course DLBDSEIMB02: International Brand Management 273

Module DLBDSEAS: Applied Sales
Module Description 278
Course DLBDSEAS01: Applied Sales I 281
Course DLBDSEAS02: Applied Sales II 285

Module DLBDSESCM: Supply Chain Management
Module Description 289
Course DLBDSESCM01: Supply Chain Management I 292
Course DLBDSESCM02: Supply Chain Management II 296

6. Semester

Module DLBSEWMG_E: Mathematics Basics
Module Description . . . 301
Course DLBCSM101: Mathematics I . . . 303
Course DLBCSM201: Mathematics II . . . 307

Module DLBSEWMLAA_E: Mathematics: Linear Algebra and Analysis
Module Description . . . 311
Course DLBDSMFLA01: Mathematics: Linear Algebra . . . 313
Course DLBDSMFC01: Mathematics: Analysis . . . 317

Module DLBSEWSG-02_E: Statistics Basics
Module Description . . . 321
Course DLBDSSPDS01-01: Statistics: Probability and Descriptive Statistics . . . 323
Course DLBDSSIS01-01: Statistics - Inferential Statistics . . . 327

Module DLBSEWDSPP-01_E: Data Science and Object Oriented Programming with Python
Module Description . . . 331
Course DLBDSIDS01-01: Introduction to Data Science . . . 333
Course DLBDSOOFPP01: Project: Object Oriented and Functional Programming in Python . . . 337

Module DLBSEWITES_E: Internet of Things and Embedded Systems
Module Description . . . 341
Course DLBINGEIT01_E: Introduction to the Internet of Things . . . 343
Course DLBROES01_E: Embedded Systems . . . 347

Module DLBSEWRI-01_E: Robotics and Production Engineering
Module Description . . . 351
Course DLBROIR01-01_E: Introduction to Robotics . . . 354
Course DLBDSEAR01: Production Engineering Industry 4.0 . . . 358

Module DLBSEWIML_E: International Management and Leadership
Module Description . . . 363
Course BWINT01: International Management . . . 366
Course DLBWPLS01_E: Leadership 4.0 . . . 373

Module DLBDSEIMB: International Marketing and Branding
Module Description . . . 378
Course DLBDSEIMB01: International Marketing . . . 381
Course DLBDSEIMB02: International Brand Management . . . 387

Module DLBDSEAS: Applied Sales
Module Description . . . 392
Course DLBDSEAS01: Applied Sales I . . . 395

Course DLBDSEAS02: Applied Sales II 399

Module DLBDSESCM: Supply Chain Management
Module Description 403
Course DLBDSESCM01: Supply Chain Management I 406
Course DLBDSESCM02: Supply Chain Management II 410

Module DLBCSEBI: Business Intelligence
Module Description 414
Course DLBCSEBI01: Business Intelligence 416
Course DLBCSEBI02: Project: Business Intelligence 420

Module DLBINGSD_E: Smart Devices
Module Description 423
Course DLBINGSD01_E: Smart Devices 425
Course DLBINGSD02_E: Project: Smart Devices 430

Module DLBDSESF: Smart Factory
Module Description 433
Course DLBDSESF01: Smart Factory 436
Course DLBDSESF02: Project: Smart Factory 441

Module DLBINGSM_E: Smart Mobility
Module Description 445
Course DLBINGSM01_E: Smart Mobility 447
Course DLBINGSM02_E: Project: Smart Mobility 451

Module DLBINGSS_E: Smart Services
Module Description 453
Course DLBINGSS01_E: Smart Services 455
Course DLBINGSS02_E: Project: Smart Services 460

Module DLBCSEEISC_E: IT Security Consulting
Module Description 463
Course DLBCSEEISC01_E: Technical and Operational IT Security Concepts 466
Course DLBCSEEISC02_E: Project: Configuration and Application of SIEM Systems 470

Module BWCN_E: Business Consulting
Module Description 474
Course BWCN01_E: Business Consulting I 476
Course BWCN02_E: Business Consulting II 480

Module DLBMIAMVR_E: Augmented, Mixed and Virtual Reality
Module Description 484
Course DLBMIAMVR01_E: Augmented, Mixed and Virtual Reality 486

Course DLBMIAMVR02_E: Project: X-Reality 492

Module DLBBWWDM_E: Digital Business
Module Description 497
Course DLBLODB01_E: Digital Business Models 499
Course DLBINGDT01_E: Project: Design Thinking 503

Module DLBDSEDE: Data Engineer
Module Description 507
Course DLBDSEDE01: Data Engineering 509
Course DLBDSEDE02: Project: Data Engineering 513

Module DLBMIUEX_E: User Experience
Module Description 515
Course DLBMIUEX01_E: User Experience 517
Course DLBMIUEX02_E: UX-Project 522

Module DLBDSEAIS: AI Specialist
Module Description 525
Course DLBDSEAIS01: Artificial Intelligence 527
Course DLBDSEAIS02: Project: Artificial Intelligence 532

Module DLBSG_E: Studium Generale I and II
Module Description 537
Course DLBSG01_E: Studium Generale I 539
Course DLBSG02_E: Studium Generale II 542

Module DLBWMP_E: Mastering Prompts
Module Description 545
Course DLBDSEAIS01: Artificial Intelligence 547
Course DLBPKIEKPT01_E: Project: AI Excellence with Creative Prompting Techniques 552

Module DLBMSERP: Microsoft ERP- Dynamics 365 Business Central - Functional Consultant
Module Description 557
Course DLBMSERP01: Project: Dynamics 365 Business Central - Financial Company Setup 560
Course DLBMSERP02: Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution 565

Module DLBSAPBPI: SAP - SAP S/4HANA Business Process Integration - Application Associate
Module Description 570
Course DLBSAPBPI01: Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management 573
Course DLBSAPBPI02: Project: SAP S/4HANA - Business Processes 578

Module DLBKAENT_E: Career Development

Module Description 583
Course DLBKAENT01_E: Personal Career Plan 586
Course DLBKAENT02_E: Personal Elevator Pitch 592

Module DLBAWSCLSP: AWS Cloud Specialization
Module Description 597
Course DLBPAWSCLES01: Project: AWS - Cloud Essentials 600
Course DLBPAWSCLAD01: Project: AWS - Cloud Advanced 605

Module DLBBT: Bachelor Thesis
Module Description 611
Course DLBBT01: Bachelor Thesis 613
Course DLBBT02: Colloquium 617

1. Semester

Software Engineering Principles

Module Code: IGIS_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Markus Kleffmann (Software Engineering Principles)

Contributing Courses to Module

- Software Engineering Principles (IGIS01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- binary system
- Structure and function of computer systems
- Structure and function of communication networks
- Software life cycle
- Roles, phases, activities in software engineering

Learning Outcomes

Software Engineering Principles

On successful completion, students will be able to

- perform simple calculations in the binary system (Boolean algebra).
- describe the structure of computer systems and communication networks.
- distinguish between the phases of a SW life cycle.
- distinguish roles and phases in the software process.
- know different process models of SW development.
- know typical challenges and risks of enterprise SW development.
- know different programming paradigms and their application.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Software Engineering Principles

Course Code: IGIS01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of the course is to give students an insight into the technical and theoretical basics of software engineering. In addition to the general structure of computer systems, students are taught typical challenges in the development of enterprise information systems. Furthermore, the typical phases and activities in software engineering are presented to address these risks.

Course Outcomes

On successful completion, students will be able to

- perform simple calculations in the binary system (Boolean algebra).
- describe the structure of computer systems and communication networks.
- distinguish between the phases of a SW life cycle.
- distinguish roles and phases in the software process.
- know different process models of SW development.
- know typical challenges and risks of enterprise SW development.
- know different programming paradigms and their application.

Contents

1. Structure and organization of information systems
   - 1.1 0 and 1 as the basis of all IT systems
   - 1.2 Von Neumann Architecture
   - 1.3 Distributed systems and communication networks
   - 1.4 Enterprise information systems

2. Risks and challenges of enterprise software engineering
   - 2.1 Properties of enterprise software systems
   - 2.2 Software Engineering
   - 2.3 Risks and typical problems
   - 2.4 Root cause analysis
   - 2.5 Challenges in Software Engineering

3. Software life cycle: from planning to replacement
   - 3.1 The software life cycle at a glance

3.2 Planning
3.3 Development
3.4 Operation
3.5 Maintenance
3.6 Shutdown

4. Requirements engineering and specification
4.1 requirements engineering
4.2 Specification

5. Architecture and implementation
5.1 Architecture
5.2 Implementation

6. Testing, operation and evolution
6.1 Testing
6.2 Operation
6.3 Evolution

7. Roles in Software Engineering
7.1 Idea of the role-based approach
7.2 Typical roles

8. Organization of software projects
8.1 From process paradigm towards software process
8.2 Process Paradigms

9. Software Process Frameworks
9.1 V-model XT
9.2 Rational Unified Process (RUP)
9.3 Scrum

Literature
Compulsory Reading
Further Reading ▪ Pohl, K., & Rupp., C. (2015). Requirements engineering (2nd ed.). Rocky Nook. ▪ Sommerville, I. (2016). Software engineering (10th ed.). Pearson. ▪ Sommerville, I. (2019). Engineering software products: An introduction to modern software engineering. Pearson. ▪ Jacobson, I., Lawson, H., & Ng, P.-W. (2019). The essentials of modern software engineering. ACM Books.

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Introduction to Academic Work

Module Code: DLBCSIAW

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Brigitte Huber (Introduction to Academic Work)

Contributing Courses to Module

- Introduction to Academic Work (DLBCSIAW01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Basic Workbook (passed / not passed) Study Format: Distance Learning Basic Workbook (passed / not passed)	

Weight of Module

see curriculum

Module Contents

- Scientific Theoretical Foundations and Research Paradigms
- Application of Good Scientific Practice
- Methodology
- Librarianship: Structure, Use, and Literature Management
- Forms of Scientific Work at IU

Learning Outcomes

Introduction to Academic Work

On successful completion, students will be able to

- understand and apply formal criteria of a scientific work.
- distinguish basic research methods and identify criteria of good scientific practice.
- describe central scientific theoretical basics and research paradigms and their effects on scientific research results.
- use literature databases, literature administration programs, and other library structures properly; avoid plagiarism; and apply citation styles correctly.
- apply the evidence criteria to scientific texts.
- define a research topic and derive a structure for scientific texts.
- compile a list of literature, illustrations, tables, and abbreviations for scientific texts.
- understand and distinguish between the different forms of scientific work at IU.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Methods	All Bachelor Programs in the Business field

Introduction to Academic Work

Course Code: DLBCSIAW01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The application of good scientific practice is one of the basic academic qualifications that should be acquired while studying. This course deals with the distinction between everyday knowledge and science. This requires a deeper understanding of the theory of science, as well as the knowledge of basic research methods and instruments for writing scientific texts. The students therefore gain initial insight into academic research and are introduced to the basic knowledge that will help them in the future to produce scientific papers. In addition, the students receive an overview of the different IU examination forms and insight into their requirements and implementation.

Course Outcomes

On successful completion, students will be able to

- understand and apply formal criteria of a scientific work.
- distinguish basic research methods and identify criteria of good scientific practice.
- describe central scientific theoretical basics and research paradigms and their effects on scientific research results.
- use literature databases, literature administration programs, and other library structures properly; avoid plagiarism; and apply citation styles correctly.
- apply the evidence criteria to scientific texts.
- define a research topic and derive a structure for scientific texts.
- compile a list of literature, illustrations, tables, and abbreviations for scientific texts.
- understand and distinguish between the different forms of scientific work at IU.

Contents

1. Theory of Science
   - 1.1 Introduction to Science and Research
   - 1.2 Research Paradigms
   - 1.3 Fundamental Research Decisions
   - 1.4 Effects of Scientific Paradigms on Research Design
2. Application of Good Scientific Practice
   - 2.1 Research Ethics
   - 2.2 Evidence Teaching

- 2.3 Data Protection and Affidavit
- 2.4 Orthography and Shape
- 2.5 Identification and Delimitation of Topics
- 2.6 Research Questions and Structure

3. Research Methods
   - 3.1 Empirical Research
   - 3.2 Literature and Reviews
   - 3.3 Quantitative Data Collection
   - 3.4 Qualitative Data Collection
   - 3.5 Mix of Methods
   - 3.6 Critique of Methods and Self-Reflection

4. Librarianship: Structure, Use, and Literature Management
   - 4.1 Plagiarism Prevention
   - 4.2 Database Search
   - 4.3 Literature Administration
   - 4.4 Citation and Author Guidelines
   - 4.5 Bibliography

5. Scientific Work at the IU – Research Essay
6. Scientific Work at the IU - Project Report
7. Scientific Work at the IU - Case Study
8. Scientific Work at the IU - Bachelor Thesis
9. Scientific Work at the IU – Oral Assignment
10. Scientific Work at the IU – Oral Project Report
11. Scientific Work at the IU - Colloquium
12. Scientific Work at the IU - Portfolio
13. Scientific Work at the IU - Exam

Literature
Compulsory Reading
Further Reading ▪ Bell, J., & Waters, S. (2018). Doing your research project: A guide for first-time researchers (7th ed.). Open University Press McGraw-Hill Education. ▪ Deb, D., Dey, R., & Balas, V. E. (2019). Engineering research methodology: A practical insight for researchers. Springer. ▪ Saunders, M., Lewis, P., & Thornhill, A. (2019). Research Methods for Business Students (8th ed.). Pearson. ▪ Veal, A. J. (2018). Research Methods for Leisure and Tourism (5th ed.). Pearson.

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Basic Workbook (passed / not passed)

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Online Tests
- ☑ Guideline

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Basic Workbook (passed / not passed)

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Requirements Engineering

Module Code: DLBCSRE

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Andrew Adjah Sai (Requirements Engineering)

Contributing Courses to Module

- Requirements Engineering (DLBCSRE01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes Study Format: myStudies Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Basics of requirements engineering
- Enterprise modeling
- Requirement determination techniques
- Techniques of requirements documentation
- Testing and coordination of requirements
- Managing requirements

Learning Outcomes

Requirements Engineering

On successful completion, students will be able to

- describe models of enterprise modeling relevant to IT support and have experience in modeling.
- understand techniques and methods for determining requirements of IT systems and be able to distinguish them from each other.
- understand techniques for the documentation of requirements on IT systems and have experience in their use.
- describe techniques for testing, coordinating, and managing the requirements of IT systems and be able to distinguish between them.
- independently select suitable techniques and methods of requirements engineering for given project situations.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Requirements Engineering

Course Code: DLBCSRE01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The early phases of software development are largely characterized by the fact that functional and technical requirements for the IT system have to be determined. The determination of these requirements must be carried out extremely carefully because all of the following activities in the SW development process are planned and executed on the basis of documented requirements. In this course, procedures, methods, and models are covered, which make it possible to have a structured and methodical determination and documentation of requirements for operational information systems.

Course Outcomes

On successful completion, students will be able to

- describe models of enterprise modeling relevant to IT support and have experience in modeling.
- understand techniques and methods for determining requirements of IT systems and be able to distinguish them from each other.
- understand techniques for the documentation of requirements on IT systems and have experience in their use.
- describe techniques for testing, coordinating, and managing the requirements of IT systems and be able to distinguish between them.
- independently select suitable techniques and methods of requirements engineering for given project situations.

Contents

1. Fundamentals and Terms of Requirements Engineering
   - 1.1 Requirements Engineering in the Software Process
   - 1.2 Core Activities in Requirements Engineering
   - 1.3 What is a Requirement?
2. Determination of Requirements
   - 2.1 Determination of the System Context
   - 2.2 Determination of the Sources of Requirements
   - 2.3 Selection of the Appropriate Investigative Techniques
   - 2.4 Determine Requirements Using Techniques

3. Selected Investigative Techniques
   - 3.1 Creativity Techniques
   - 3.2 Interview Techniques
   - 3.3 Observation Techniques
   - 3.4 Prototyping

4. Documentation of Requirements
   - 4.1 Activities for Documenting Requirements
   - 4.2 Typical Elements of Requirements Documentation
   - 4.3 Forms of Documentation

5. Modeling of Processes
   - 5.1 Basics and Terms
   - 5.2 Modeling with the Business Process Model and Notation
   - 5.3 Modeling with Event Driven Process Chains

6. Modeling of Systems
   - 6.1 Fundamentals of Unified Modeling Language
   - 6.2 UML Use Case Diagram
   - 6.3 UML Activity Diagram
   - 6.4 UML Class Diagram
   - 6.5 UML State Diagram

7. Checking and Reconciling Requirements
   - 7.1 Activities for Checking and Reconciling Requirements
   - 7.2 Test Criteria
   - 7.3 Test Principles
   - 7.4 Testing Techniques
   - 7.5 Coordination of Requirements

8. Management of Prioritization Requirements and Techniques
   - 8.1 Managing Requirements
   - 8.2 Techniques for Prioritizing Requirements

Literature
Compulsory Reading
Further Reading ▪ Dick, J., Hull, E., & Jackson, K. (2017). Requirements engineering (4th ed.). Springer. ▪ Glinz, M., van Loenhoud, H., Staal, S., & Bühne, S. (2020). Handbook for the CPRE foundation level according to the IREB standard: Education and training for certified professional for requirements engineering (CPRE): Foundation level (Version 1.0.0). InternationalRequirements Engineering Board. ▪ Pohl, K., & Rupp, C. (2015). Requirements engineering fundamentals: A study guide for the certified professional for requirements engineering exam: Foundation level—IREB compliant (2nd ed.). Rocky Nook.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Specification

Module Code: DLBCSS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Holger Klus (Specification)

Contributing Courses to Module

- Specification (DLBCSS01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes Study Format: myStudies Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Basics of specification
- Specification of user interfaces (GUIs)
- Specification of components and their interfaces
- Technical specification of detailed technical data models
- Specification of business rules
- Specification of data interfaces
- Specification of web services
- Specification of quality and limiting contraints

Learning Outcomes

Specification

On successful completion, students will be able to

- know the motivation, use cases, and scenarios for the practical use of technical specifications.
- distinguish techniques from each other for the detailed specification of application interfaces and business logic of information systems and have experience with their use.
- identify and independently specify business objects and components.
- describe techniques for the detailed specification of technical interfaces between IT systems and be able to specify interfaces independently.
- explain techniques and procedures for the technical specification of quality properties and limiting conditions.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field(s) of Computer Science & Software Development.	All Bachelor Programmes in the IT & Technology field(s).

Specification

Course Code: DLBCSS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Based on the results of the technical requirements analysis, requirements for IT systems must be described as precisely as is appropriate for the respective situation. Based on specifications, project costs are estimated, and decisions are made about the internal design of the system.In this course different models and techniques that are used for the detailed specification of requirements for a system, subsystem, or system component are taught. The structure of the course is based on the structure of typical business information systems. In addition to the application layers, user interface, business logic, and data layer, the specification of web services is also covered.

Course Outcomes

On successful completion, students will be able to

- know the motivation, use cases, and scenarios for the practical use of technical specifications.
- distinguish techniques from each other for the detailed specification of application interfaces and business logic of information systems and have experience with their use.
- identify and independently specify business objects and components.
- describe techniques for the detailed specification of technical interfaces between IT systems and be able to specify interfaces independently.
- explain techniques and procedures for the technical specification of quality properties and limiting conditions.

Contents

1. Introduction to the Specification of Software Systems
   - 1.1 Basics and Terms for Specification
   - 1.2 Elements and Outlines of Specifications
   - 1.3 Structures and Forms of Documentation for Specification
2. Specification of User Interfaces (GUIs)
   - 2.1 Elements of a GUI Specification
   - 2.2 GUI Elements in Individual Dialog Masks
   - 2.3 Validations
   - 2.4 Navigation Between Dialogue Masks

3. Specification of System Components
   - 3.1 Introduction and Motivation for Components
   - 3.2 Specifying the Structure of Systems and Components
   - 3.3 Specification of Component Behavior

4. Specification of Technical System Interfaces
   - 4.1 Specifying Behavior at Interfaces of Components
   - 4.2 Data Structures at Interfaces of Components

5. Specification of Detailed Business Data Models
   - 5.1 Areas of Application of Technical Data Models
   - 5.2 Detailing the UML Class Diagram
   - 5.3 Checking Class Diagrams with UML Object Diagrams
   - 5.4 Typical Elements in Domain-Oriented Data Models

6. Specification of Data Interfaces with Structured Text
   - 6.1 Structured Text as Exchange Format
   - 6.2 Structure and Structure of XML Documents
   - 6.3 Definition of XML Languages
   - 6.4 Derivation of Class Diagrams From XML formats
   - 6.5 Specifying Web Services with WSDL

7. Specification of Quality Properties
   - 7.1 Quality and Quality Models
   - 7.2 Goal/Question/Metric Method (GQM)

Literature

Compulsory Reading

Further Reading

- Chonoloes, M. J. (2017). OCUP 2 certification guide: Preparing for the OMG certified UML 2.5professional 2 foundation exam. Morgan Kaufmann.
- Somerville, I. (2018). Software engineering (Global ed., 10th ed.). Pearson Education.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Object-oriented Programming with Java

Module Code: DLBCSOOPJ

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Sebastian Lempert (Object-oriented Programming with Java)

Contributing Courses to Module

- Object-oriented Programming with Java (DLBCSOOPJ01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes Study Format: myStudies Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Introduction to the Java language
- Java language constructs
- Introduction to object-oriented system developement
- Inheritance
- Object-oriented concepts
- Exception handling
- Interfaces

Learning Outcomes

Object-oriented Programming with Java

On successful completion, students will be able to

- describe the basic concepts of object-oriented modeling and programming, distinguishing them from one another.
- describe the basic concepts and elements of the Java programming language and have some experience in their use.
- independently create Java programs to solve concrete problems.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programmes in the IT & Technology field

Object-oriented Programming with Java

Course Code: DLBCSOOPJ01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Operational information systems are usually planned and programmed to be object-oriented. Therefore, this course teaches the basic skills of object-oriented programming. Theoretical concepts are presented and practiced directly with the programming language Java.

Course Outcomes

On successful completion, students will be able to

- describe the basic concepts of object-oriented modeling and programming, distinguishing them from one another.
- describe the basic concepts and elements of the Java programming language and have some experience in their use.
- independently create Java programs to solve concrete problems.

Contents

1. Introduction to Object-Oriented System Development
   - 1.1 Object Orientation as a Way of Looking at Complex Systems
   - 1.2 The Object as a Basic Concept of Object Orientation
   - 1.3 Phases in the Object-Oriented Development Process
   - 1.4 Basic Principle of Object-Oriented System Development
2. Introduction to Object-Oriented Modeling
   - 2.1 Structuring Problems With Classes
   - 2.2 Identifying Classes
   - 2.3 Attributes as Properties of Classes
   - 2.4 Methods as Functions of Classes
   - 2.5 Associations between Classes
   - 2.6 Unified Modeling Language (UML)
3. Programming Classes in Java
   - 3.1 Introduction to the Java Programming Language
   - 3.2 Basic Elements of a Class in Java
   - 3.3 Attributes in Java

3.4 Methods in Java
3.5 Main Method: Starting Point of a Java Program

4. Java Language Constructs
4.1 Primitive Data Types
4.2 Variables
4.3 Operators and Expressions
4.4 Control Structures
4.5 Packages and Visibility Modifiers .

5. Inheritance
5.1 Modeling and Inheritance in the Class Diagram
5.2 Programming Inheritance in Java

6. Important Object-Oriented Concepts
6.1 Abstract Classes
6.2 Polymorphism
6.3 Static Attributes and Methods

7. Constructors for Generating Objects
7.1 The Standard Constructor
7.2 Overloading Constructors
7.3 Constructors and Inheritance

8. Handling Exceptions with Exceptions
8.1 Typical Scenarios of Exception Handling
8.2 Standard Exceptions in Java
8.3 Defining Your Own Exceptions

9. Programming Interfaces with Interfaces
9.1 Typical Scenarios of Programming Interfaces
9.2 Interfaces as Programming Interfaces in Java

Literature

Compulsory Reading

Further Reading

- Freeman, E., Robson, E., Bates, B., & Sierra, K. (2014). Head first design patterns (A brain friendly guide). O'Reilly Media.
- Gamma, E., Helm, R., Johnson, R., & Vlissides, J. (1995). Design patterns: Elements of re-usable object-oriented software. Addison-Wesley.
- Liang, Y. D. (2018). Introduction to Java programming and data structures. Pearson Education.
- Liguiori, L. & Liguori, P. (2008). Java pocket guide: Instant help for Java. O'Reilly Media.
- Oracle (2017). The Java tutorials. Available online.
- Samoylov, N. (2019). Learn Java 12 programming: A step-by-step guide to learning essential concepts in Java SE 10, 11, and 12. Packt Publishing.
- Weisfeld M. (2019). The object-oriented thought process (5th ed.). Addison-Wesley.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Database Modeling and Database Systems

Module Code: DLBCSDMDS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Carsten Skerra (Database Modeling and Database Systems)

Contributing Courses to Module

- Database Modeling and Database Systems (DLBCSDMDS01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Fundamentals of Relational Databases
- Simple Database Queries
- Entity/Relationship (E/R) Diagrams
- Database Development
- Complex Database Queries Across Multiple Tables
- Changing Data in Databases
- NoSQL Database Systems

Learning Outcomes

Database Modeling and Database Systems

On successful completion, students will be able to

- describe the basic concepts of the relational data model and distinguish them from each other.
- visually model data schemas.
- know SQL queries, read data from databases, change the data stock, and have experience in their use.
- design, create, and modify SQL queries and data schemas for SQL databases, and have experience using them.
- independently design database schemas and create database queries to solve concrete problems.
- know the most important NoSQL concepts and distinguish them from each other.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

Database Modeling and Database Systems

Course Code: DLBCSDMDS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Stored data form the basis of many value chains of an information and knowledge society. The methodical structuring of data through data schemas therefore forms an important basis for storing information in such a way that it can be retrieved and processed quickly and easily. In addition to the structured storage of data, structured access to large amounts of data must also be possible.This course teaches students how to store data in relational data models and how to access stored data with SQL. In addition to relational database systems, modern DB systems (NoSQL) for storing and accessing data will be presented.

Course Outcomes

On successful completion, students will be able to

- describe the basic concepts of the relational data model and distinguish them from each other.
- visually model data schemas.
- know SQL queries, read data from databases, change the data stock, and have experience in their use.
- design, create, and modify SQL queries and data schemas for SQL databases, and have experience using them.
- independently design database schemas and create database queries to solve concrete problems.
- know the most important NoSQL concepts and distinguish them from each other.

Contents

1. Fundamentals of Relational Databases
   - 1.1 Basic Concepts of the Relational Data Model
   - 1.2 Find and Delete Records in the Database
   - 1.3 SQL and Relational Database Systems
2. Querying Data from a Single Table
   - 2.1 Query Data (SELECT)
   - 2.2 Query Data With Condition (WHERE)
   - 2.3 Sort Query Output (ORDER BY)
   - 2.4 Queries With Group Formation (GROUP BY)

2.5 Subqueries With Nested SELECT Statements

3. Conception and Modeling of Relational Databases
   - 3.1 The Entity Relationship Model
   - 3.2 Relationships and Cardinalities in E/R Models
   - 3.3 Normal Forms of Databases

4. Creation of Relational Databases
   - 4.1 Logical Database Design Activities
   - 4.2 Mapping of the Conceptual Data Model into the Physical Data Model
   - 4.3 Generation of Tables in SQL Databases from E/R Diagrams

5. Complex Database Queries on Multiple Tables
   - 5.1 Composite Quantities (JOIN)
   - 5.2 Set Operations
   - 5.3 Data Views With CREATE VIEW

6. Manipulating Records in Databases
   - 6.1 Insert New Data Records (INSERT)
   - 6.2 Change Existing Records
   - 6.3 Transactions

7. NoSQL Database Systems
   - 7.1 Motivation and Basic Idea
   - 7.2 Selected Groups of NoSQL Systems

Literature

Compulsory Reading

Further Reading

- Date, C.J. (2019). Database design and relational theory: Normal forms and all that jazz (2nd ed.). Apress.
- Elmasri, R., & Navathe, S. (2017). Fundamentals of database systems (7th ed., global ed.). Pearson.
- Esakkirajan, S., & Sumathi, S. (2007). Fundamentals of relational database management systems [electronic resource] : Springer.
- Foster, E. C., & Godbole, S. V. (2016). Database systems: a pragmatic approach (2nd ed.). Apress.
- W3Schools (2020). SQL Tutorial.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

2. Semester

Data Structures and Java Class Library

Module Code: DLBCSDSJCL

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Sebastian Lempert (Data Structures and Java Class Library)

Contributing Courses to Module

- Data Structures and Java Class Library (DLBCSDSJCL01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Programming style
- Working with objects
- External packages and libraries
- Data structures
- Strings and calendar
- File system and data streams

Learning Outcomes

Data Structures and Java Class Library

On successful completion, students will be able to

- understand typical data structures and distinguish them from each other.
- independently create solutions in the Java programming language using the data structures.
- understand scenarios and strategies for comparing objects and implement them in Java.
- describe the possible uses and functions of character strings and calendar objects in Java and have experience using them.
- describe the possible uses and functions of streams in Java and have experience using them.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development.	All Bachelor Programmes in the IT & Technology fields

Data Structures and Java Class Library

Course Code: DLBCSDSJCL01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Based on the contents of the course "Basics of object-oriented programming with Java", this course deepens the knowledge of object-oriented programming. In particular, data structures, their use cases, and their implementation in the Java language are considered. In addition, strategies and scenarios of object comparisons, the use of functions of the "String" data type, the use of calendar objects, and the use of streams are taught.

Course Outcomes

On successful completion, students will be able to

- understand typical data structures and distinguish them from each other.
- independently create solutions in the Java programming language using the data structures.
- understand scenarios and strategies for comparing objects and implement them in Java.
- describe the possible uses and functions of character strings and calendar objects in Java and have experience using them.
- describe the possible uses and functions of streams in Java and have experience using them.

Contents

1. Programming Style
   - 1.1 Code Documentation
   - 1.2 Code Annotations
   - 1.3 Code Conventions
2. Working with Objects
   - 2.1 String Representation of Objects
   - 2.2 Compare with ==
   - 2.3 Compare with Equals()
   - 2.4 Compare by HashCode()
   - 2.5 CompareTo()
   - 2.6 Cloning Objects
3. External Packages and Libraries
   - 3.1 Importing Packages

3.2 The Java Class Library

4. Data Structures
   - 4.1 Arrays
   - 4.2 Collections
   - 4.3 Working with Collections
   - 4.4 Lists
   - 4.5 Quantities (Sets)
   - 4.6 Associative Memory (Maps)
   - 4.7 Stacks (Basement)
   - 4.8 Queues (Snakes)

5. Strings and Calendar
   - 5.1 Strings
   - 5.2 StringBuffer
   - 5.3 Splitting Character Strings
   - 5.4 Date and time
   - 5.5 Calendar

6. File System and Data Streams
   - 6.1 Working with the File System
   - 6.2 Working with Files

Literature

Compulsory Reading

Further Reading

- Bloch, J. (2017). Effective Java (3rd ed.). Addison-Wesley.
- Oracle. (2018a). Java platform standard edition 10 API specification. (Available online).
- Oracle. (2018b). String (Java platform SE 10). (Available online).
- Oracle. (2018c). Date (Java platform SE 10). (Available online).
- Oracle. (2018d). java.io (Java platform SE 10). (Available online).
- Oracle. (2019). The Java language specification: Java SE 11 edition. (Available online).
- Seidl, M. (2015). UML@Classroom: An introduction to object-oriented modeling. Springer.

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Collaborative Work

Module Code: DLBCSCW

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Karin Halbritter (Collaborative Work)

Contributing Courses to Module

- Collaborative Work (DLBCSCW01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Oral Assignment Study Format: Duales myStudium Oral Assignment Study Format: Distance Learning Oral Assignment	

Weight of Module

see curriculum

Module Contents

- Self-Directed and Collaborative Learning
- Networking and Cooperation
- Performance in (Virtual) Teams
- Communication, Arguments, and Being Convincing
- Potentials for Conflict and Managing Conflicts
- Self-Management and Personal Skills

Learning Outcomes

Collaborative Work

On successful completion, students will be able to

- design their own learning processes both self-directed and collaborative with analog and digital media.
- initiate face-to-face and virtual cooperation and select suitable methods for shaping collaboration even in an intercultural context and across disciplinary boundaries.
- assess different forms of communication in relation to the goals and requirements of different situations and to reflect on their own communication and argumentation behavior in order to be able to shape conducive collaboration also in an interdisciplinary context.
- recognize social diversity including cultural and professional differences as a value, and to name and apply tools to deal with them constructively.
- explain conflict potentials and the role of emotions in conflicts and to describe the use of systemic methods in the target- and solution-oriented handling of conflicts.
- analyze one's own resources, present methods of self-leadership and self-motivation, and derive appropriate strategies.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Business Administration & Management	All Bachelor Programs in the Business field

Collaborative Work

Course Code: DLBCSCW01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The course supports the students in building up and expanding important interdisciplinary competences for our networked world, and in doing so, students can take advantage of the opportunities for constructive cooperation with others. It presents essential forms and design possibilities of collaborative learning and working, imparts basic knowledge and tools for self-managed, flexible, and creative thinking, learning and acting and familiarizes students with the topics of empathy and emotional intelligence. Students are also encouraged to use the course contents. In this way, they promote their autonomous competence to act and their competence in the interactive application of tools and in interacting in heterogeneous groups.

Course Outcomes

On successful completion, students will be able to

- design their own learning processes both self-directed and collaborative with analog and digital media.
- initiate face-to-face and virtual cooperation and select suitable methods for shaping collaboration even in an intercultural context and across disciplinary boundaries.
- assess different forms of communication in relation to the goals and requirements of different situations and to reflect on their own communication and argumentation behavior in order to be able to shape conducive collaboration also in an interdisciplinary context.
- recognize social diversity including cultural and professional differences as a value, and to name and apply tools to deal with them constructively.
- explain conflict potentials and the role of emotions in conflicts and to describe the use of systemic methods in the target- and solution-oriented handling of conflicts.
- analyze one's own resources, present methods of self-leadership and self-motivation, and derive appropriate strategies.

Contents

1. Learning for a Networked World, in a Networked World
    - 1.1 Requirements and Opportunities in the “VUCA” World
    - 1.2 Learning, Knowing and Not-Knowing
    - 1.3 The 4C Model: Collective, Collaborative, Continuous, and Connected
    - 1.4 Monitoring Learning Behaviour

2. Networking & Cooperation
   - 2.1 Cooperation Partners
   - 2.2 Sustainable Relationships: Digital Interaction and Trust Building
   - 2.3 Organizing Collaboration
   - 2.4 Social Learning

3. Performance in (Online) Teams
   - 3.1 Goals, Roles, Organization and Performance Measurement
   - 3.2 Team Building and Team Flow
   - 3.3 Agile Project Management with Scrum
   - 3.4 Other Agile Methods

4. Communicating and Convincing
   - 4.1 Communication as Social Interaction
   - 4.2 Language, Images, Metaphors, and Stories
   - 4.3 Attitude: Open, Empathetic, and Appreciative Communication
   - 4.4 Active Listening
   - 4.5 Analyze Your Conversational and Argumentative Skills

5. Recognizing Conflict Potential — Managing Conflicts — Negotiating Effectively
   - 5.1 Respecting Diversity and Seizing Opportunities
   - 5.2 Empathy
   - 5.3 Systemic Solution Process Work
   - 5.4 Constructive Negotiation

6. Achieving Your Goals
   - 6.1 Effective Goal Setting
   - 6.2 The Agile Use of Time
   - 6.3 (Self-)Coaching Methods
   - 6.4 Self-Management and Motivation Strategies

7. Mobilizing Resources
   - 7.1 Recognizing Resources
   - 7.2 Reflection and Innovation
   - 7.3 Transfer Strength and Willpower

Literature
Compulsory Reading
Further Reading ▪ Baber, A., Waymon, L., Alphonso, A., & Wylde, J. (2015). Strategic connections: The new face of networking in a collaborative world. AMACOM. ▪ Kaats, E., & Opheij, W. (2014). Creating conditions for promising collaboration: Alliances, networks, chains, strategic partnerships. Springer. ▪ Martin, S. J., Goldstein, N. J., & Cialdini, R. B. (2014). The small BIG: Small changes that spark BIG influence. Profile Books. ▪ Oettingen, G. (2014). Rethinking positive thinking: Inside the new science of motivation. Current.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Oral Assignment

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Online Tests
- ☑ Guideline

Study Format Duales myStudium

Study Format	**Course Type**
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Oral Assignment

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Oral Assignment

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Web Application Development

Module Code: DLBCSWAD

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Thomas Bolz (Web Application Development)

Contributing Courses to Module

- Web Application Development (DLBCSWAD01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Advanced Workbook Study Format: Distance Learning Advanced Workbook	

Weight of Module

see curriculum

Module Contents

- Architectural Foundations
- Tools of web development
- HTML
- CSS
- Javascript
- Web application testing and security

Learning Outcomes

Web Application Development

On successful completion, students will be able to

- identify important elements and describe the structure of current web application architectures.
- write simple static web pages using HTML.
- design simple web pages using CSS.
- store and handle structured information using XML.
- program simple dynamic web content using PHP.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development.	All Bachelor Programmes in the IT & Technology field.

Web Application Development

Course Code: DLBCSWAD01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

TThis course aims to empower students to program simple web applications using established technologies. At first, they will gain important insights into the typical structure of current web application architectures. Based on that knowledge, the students will learn the hypertext markup language (HTML) to develop simple web pages. Next, they will familiarize themselves with the most important and common elements of the cascading stylesheet (CSS) standard to layout the content written in HTML. To implement simple dynamic web pages, students learn how to use Javascript and exemplary supporting frameworks. This is combined with the use of relevant tools for the development and source code management of web pages. Finally, they will learn the very basics of the web page testing and security.

Course Outcomes

On successful completion, students will be able to

- identify important elements and describe the structure of current web application architectures.
- write simple static web pages using HTML.
- design simple web pages using CSS.
- store and handle structured information using XML.
- program simple dynamic web content using PHP.

Contents

1. Architectural Foundations
   - 1.1 Structure and History of the Internet
   - 1.2 Internet protocols and URIs
   - 1.3 Web application architecture
   - 1.4 Current trends
2. Tools of web development
   - 2.1 Development Tools
   - 2.2 Version management
   - 2.3 Package Manager
   - 2.4 Upload/Deployment

3. Static web pages developement
   - 3.1 Fundamentals of HTML5
   - 3.2 Fundamentals of CSS

4. Advanced design techniques
   - 4.1 Responsive web design
   - 4.2 Page layout
   - 4.3 Media queries
   - 4.4 CSS Frameworks (Bootstrap)

5. Web page development with JavaScript
   - 5.1 JavaScript history, ES5/ES6
   - 5.2 JavaScript fundamentals
   - 5.3 Use of JSON
   - 5.4 Common JavaScript Frameworks

6. Web application testing and security
   - 6.1 Testing of web applications
   - 6.2 Basic security concepts and principles

Literature

Compulsory Reading

Further Reading

- Ferguson, R. (2019). Beginning JavaScript: The ultimate guide to modern JavaScript development (3rd ed.). Apress.
- Sunyaev, A. (2020). Internet computing: Principles of distributed systems and emerging internet based technologies. Springer

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Algorithms, Data Structures, and Programming Languages

Module Code: DLBCSL-01

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimaldauer: 1 Semester	WiSe/SoSe	English

Module Coordinator

Musharaf Ahmed Doger (Algorithms, Data Structures, and Programming Languages)

Contributing Courses to Module

- Algorithms, Data Structures, and Programming Languages (DLBCSL01-01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam or Advanced Workbook, 90 Minutes Study Format: Distance Learning Exam or Advanced Workbook, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Data Structures
- Algorithm Design
- Important Algorithms
- Programming Paradigms and the Basic Terms of Programming Languages
- Programme Analysis Tools
- Overview of Common Programming Languages

Learning Outcomes

Algorithms, Data Structures, and Programming Languages

On successful completion, students will be able to

- explain basic data structures and compare and apply them in concrete applications.
- explain basic algorithms.
- design, select and apply suitable algorithms and data structures for specific applications
- analyse sketched or programmed algorithms when or before running them
- explain and compare the common programming paradigms and programming languages.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programmes in the IT & Technology field

Algorithms, Data Structures, and Programming Languages

Course Code: DLBCSL01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Programming essentially consists of selecting suitable algorithms and data structures for a specific task and converting them into program code. There are many different programming languages, which are based on different procedures and in which algorithms and data structures are implemented differently. In this module, these concepts, which have so far been dealt with using concrete examples, are systematically presented and applied more broadly in order to give students the necessary tools to develop a systematic approach to programming.

Course Outcomes

On successful completion, students will be able to

- explain basic data structures and compare and apply them in concrete applications.
- explain basic algorithms.
- design, select and apply suitable algorithms and data structures for specific applications
- analyse sketched or programmed algorithms when or before running them
- explain and compare the common programming paradigms and programming languages.

Contents

1. Basic Concepts
   - 1.1 Algorithms, Data Structures, and Programming Languages as the Basics of Programming
   - 1.2 Detailing and Abstraction
   - 1.3 Control Structures
   - 1.4 Types of Data
   - 1.5 Basic Data Structures (List, Chain, Tree)
2. Data Structures
   - 2.1 Advanced Data Structures: Queue, Heap, Stack, Graph
   - 2.2 Abstract Data Types, Objects, and Classes
   - 2.3 Polymorphism
3. Algorithm Design

- 3.1 Induction, Iteration, and Recursion
- 3.2 Methods of Algorithm Design
- 3.3 Correctness and Verification of Algorithms
- 3.4 Efficiency (Complexity) of Algorithms

4. Basic Algorithms
   - 4.1 Traversing and Linearization of Trees
   - 4.2 Search Algorithms
   - 4.3 Sorting Algorithms
   - 4.4 Search in Strings
   - 4.5 Hash Algorithms
   - 4.6 Pattern Recognition

5. Representing Structured Data
   - 5.1 Structure of XML Documents
   - 5.2 Accessing XML Documents Programmatically
   - 5.3 Transformation of XML Documents Using XSL
   - 5.4 JSON as an Alternative to XML

6. Measuring Programmes
   - 6.1 Type Inference and IDE Interactive Support
   - 6.2 Cyclomatic and Referential Complexity
   - 6.3 Digesting Code Documentation
   - 6.4 Compiler Optimization
   - 6.5 Code Coverage
   - 6.6 Unit and Integration Testing
   - 6.7 Heap Analysis

7. Programming Languages
   - 7.1 Programming Paradigms
   - 7.2 Execution of Programs
   - 7.3 Types of Programming Languages
   - 7.4 Syntax, Semantics, and Pragmatics
   - 7.5 Variables and Type Systems

8. Overview of Important Programming Languages
   - 8.1 Assembler and Webassembly
   - 8.2 C and C++

8.3 Java and C#
8.4 Haskell and Lisp
8.5 JavaScript and Its Relatives
8.6 Other Imperative Programming Languages

Literature

Compulsory Reading

Further Reading

- Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). Introduction to algorithms (4th ed.). MITPress.
- Sebesta, R. W. (2016). Concepts of programming languages (11th ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Software Quality Assurance

Module Code: DLBCSSQA

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Tobias Brückmann (Software Quality Assurance)

Contributing Courses to Module

- Software Quality Assurance (DLBCSSQA01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Systematic quality assurance of requirements, architectures, and processes
- Systematic testing of software
- Dynamic quality assurance: Testing
- Static quality assurance: Surveying and measuring
- Constructive quality management
- Organization and planning of software quality
- Introduction to software quality assurance

Learning Outcomes

Software Quality Assurance

On successful completion, students will be able to

- understand motivation, use cases, and scenarios for aspects of quality management in the software process.
- understand important terms and the basis for the conception and execution of software tests.
- understand techniques and methods for constructive quality management and be able to distinguish them from each other.
- understand techniques and methods for analytical quality management and be able to distinguish them from one another.
- understand the general course of test activities and be able to select suitable methods and techniques for quality assurance for various artefacts and activities in the software process.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field(s) of Computer Science & Software Development.	All Bachelor Programmes in the IT & Technology field(s).

Software Quality Assurance

Course Code: DLBCSSQA01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Quality assurance is one of the accompanying activities of a software process. From the beginning, all created artefacts (documents, models, and program codes) must be quality-assured because the later an error in a system is detected, the more expensive it is to fix it.The course teaches techniques and procedures for accompanying quality assurance, starting with requirements analysis through to specification, architecture and design, and implementation. Even the quality assurance activities must be quality assured so that the software systems can be delivered at a good standard.

Course Outcomes

On successful completion, students will be able to

- understand motivation, use cases, and scenarios for aspects of quality management in the software process.
- understand important terms and the basis for the conception and execution of software tests.
- understand techniques and methods for constructive quality management and be able to distinguish them from each other.
- understand techniques and methods for analytical quality management and be able to distinguish them from one another.
- understand the general course of test activities and be able to select suitable methods and techniques for quality assurance for various artefacts and activities in the software process.

Contents

1. Introduction to Software Quality Assurance
   - 1.1 Motivation and Terms
   - 1.2 Principles of SW Quality Assurance
   - 1.3 Principles in Software Testing
   - 1.4 Cost of Quality
2. Organization and Planning of Software Quality
   - 2.1 Overview of the Quality Management Process
   - 2.2 Quality Planning and Quality Objectives
   - 2.3 Quality Assurance and Quality Improvement

- 2.4 Quality Control

3. Constructive Quality Management
   - 3.1 Overview of Constructive Quality Assurance
   - 3.2 Selected Techniques

4. Static Quality Assurance: Surveying and Measuring
   - 4.1 Application and Overview of Static Processes
   - 4.2 Reviewing with Review Techniques
   - 4.3 Trade Fairs and Metrics
   - 4.4 Static Code Analysis

5. Dynamic Quality Assurance: Testing
   - 5.1 Deployment and an Overview of Dynamic Processes
   - 5.2 Use Case Based Test Case Creation
   - 5.3 Equivalence Class Formation and Limit Value Analysis
   - 5.4 State Based Test Case Creation
   - 5.5 Creation of Random Test Data

6. Systematic Testing of Software
   - 6.1 Methodological Testing Activities
   - 6.2 Component Test (Also: Module Test, Unit Test)
   - 6.3 Integration Tests
   - 6.4 System Tests
   - 6.5 Acceptance Tests

7. Systematic Quality Assurance of Requirements, Architectures, and Processes
   - 7.1 Quality Assurance of Requirements
   - 7.2 Quality Assurance of Architectures
   - 7.3 Quality Assurance of Software Processes

Literature
Compulsory Reading
Further Reading ▪ Mahfuz, A. S. (2021): Software Quality Assurance. Integrating Testing, Security, and Audit. CRC Press, Boca Raton, FL, USA. ▪ Nicolette, D. (2015): Software Development Metrics. Manning Publications, Shelter Island, NY, USA. ▪ Pohl, K.; Rupp, C. (2015): Requirements Engineering Fundamentals. A Study Guide for the Certified Professional for Requirements Engineering Exam. Foundation Level – IREB compliant. 2nd Edition. Rocky Nook, Santa Barbara, CA. ▪ Sommerville, I. (2016): Software Engineering. 10th Edition. Pearson, Harlow, Essex, England. ▪ Walkinshaw, N. (2017): Software Quality Assurance. Consistency in the Face of Complexity and Change. Springer, Cham, Switzerland.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

IT Architecture Management

Module Code: IAMG_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Claudia Heß (IT Architecture Management)

Contributing Courses to Module

- IT Architecture Management (DLBCSEITPAM02)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Basic Terms and Foundations of IT Enterprise Architectures Management
- IT Application Portfolio Management
- Architecture Governance
- Modeling of IT Enterprise Architectures
- Frameworks using TOGAF as an Example
- Reference Models and Sample Catalogues

Learning Outcomes

IT Architecture Management

On successful completion, students will be able to

- describe and explain the basic principles of IT strategy, governance, and architecture management, differentiating between them.
- explain and differentiate the typical activities of IT architecture management, their interrelationships, and their dependencies.
- explain suitable models of IT architecture management, distinguish between them, and explain their intended purpose.
- explain and describe selected IT architectural frameworks as well as reference models and sample catalogues.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science and Software Development	All Bachelor Programs in the IT & Technology field

IT Architecture Management

Course Code: DLBCSEITPAM02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In addition to concrete IT projects, such as the development of a new IT system or the introduction of standard software, a strategic management system for organizational-wide IT infrastructure – that is, for all IT hardware and software systems – must be used.Strategic management is the responsibility of the IT enterprise architect, who operates IT architecture management. Their task is to strategically align IT infrastructure with an organization's business and IT strategy.This course covers the typical concepts, methods, procedures, and IT models of architecture management.

Course Outcomes

On successful completion, students will be able to

- describe and explain the basic principles of IT strategy, governance, and architecture management, differentiating between them.
- explain and differentiate the typical activities of IT architecture management, their interrelationships, and their dependencies.
- explain suitable models of IT architecture management, distinguish between them, and explain their intended purpose.
- explain and describe selected IT architectural frameworks as well as reference models and sample catalogues.

Contents

1. Basic Terms and Foundation for the Management of IT Enterprise Architectures
   - 1.1 IT Enterprise Architecture
   - 1.2 Goals of Enterprise Architecture Management
   - 1.3 Processes in the Management of IT Enterprise Architectures
2. IT Application Portfolio Management
   - 2.1 IT Application Portfolio Management Overview
   - 2.2 Application Manual
   - 2.3 Portfolio Analysis
   - 2.4 Development Planning
3. Architecture Governance

3.1 Organizational Structure
3.2 Policy Development and Enforcement
3.3 Project Support

4. Modeling of IT Enterprise Architectures
   4.1 Models in the Context of IT Architecture Management
   4.2 Forms of Documentation for Processes and Applications
   4.3 Forms of Documentation for Systems and Technologies

5. Frameworks Using the Example of TOGAF
   5.1 Fundamentals and Use of IT Architecture Frameworks
   5.2 Overview and Categories of EAM Frameworks
   5.3 The Open Group Architecture Framework (TOGAF)

6. Reference Models and Sample Catalogues
   6.1 Architecture Reference Models
   6.2 EAM Design Sample Catalogue

Literature

Compulsory Reading

Further Reading

- Ahlemann, F., Messerschmidt, M., Stettiner, E., & Legner, C. (2012). Strategic enterprise architecture management. Challenges, best practices, and future developments. Springer-Verlag.
- Perroud, T., & Inversini, R. (2013). Enterprise architecture patterns: Practical solutions for recurring IT-architecture problems. Springer.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

3. Semester

Programming Information Systems with Java EE

Module Code: IPWA2-01_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	None	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Alexander Christopher Bock (Programming Information Systems with Java EE)

Contributing Courses to Module

- Programming Information Systems with Java EE (IPWA02-01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes Study Format: myStudies Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Component-Based Web User Interfaces
- Connecting View and Model
- Component Libraries
- Programming of Business Logic
- Programming of Database Connections

Learning Outcomes

Programming Information Systems with Java EE

On successful completion, students will be able to

- describe relevant technologies, standards, and frameworks for building enterprise web applications by using the Java technology stack and distinguish between them.
- use various web technologies for the implementation and integration of
- application interfaces, business logic and data layer.
- independently create suitable web applications to solve specifically described problems.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

Programming Information Systems with Java EE

Course Code: IPWA02-01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	None

Course Description

Building on the course "Web Application Development", this course focuses on the Java technology stack for building web applications. After an introduction to developing web application interfaces with JSF, functions for validating and converting input and programming error messages are covered.Subsequently, concepts for the implementation of navigation structures are taught. Finally, concepts and technologies for the connection to database systems are presented and applied.

Course Outcomes

On successful completion, students will be able to

- describe relevant technologies, standards, and frameworks for building enterprise web applications by using the Java technology stack and distinguish between them.
- use various web technologies for the implementation and integration of
- application interfaces, business logic and data layer.
- independently create suitable web applications to solve specifically described problems.

Contents

1. Component-Based Web User Interfaces
   - 1.1 Introduction to Jakarta Server Faces (JSF)
   - 1.2 JSF Components
2. Connecting View and Model
   - 2.1 CDI Beans
   - 2.2 Unified Expression Language (UEL)
3. Component Libraries
   - 3.1 Component Libraries
   - 3.2 PrimeFaces
4. Programming of Business Logic
   - 4.1 Validation of User Input
   - 4.2 Conversion of Numbers, Currencies and Date Fields

4.3 Definition of Error Messages
4.4 Page Navigation
4.5 JSF Lifecycle and Event Handling

5. Programming of Database Connections
5.1 Persistent Storage in Databases
5.2 Object Relational Mapping
5.3 JPA and Hibernate as Persistence Provider
5.4 Handling Objects

Literature

Compulsory Reading

Further Reading

- Hlavats, I. (2009). JSF 1.2 components. Packt.
- Jakarta Platform Team. (2021). The Jakarta EE tutorial.
- Manelli, L., & Zambon, G. (2020). Beginning JSP, JSF and Tomcat web development (3rded.). Apress.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Ethics and Sustainability in IT

Module Code: DLBSEPENIT_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Tareef Bint Ayaz Lodhi (Ethics and Sustainability in IT)

Contributing Courses to Module

- Ethics and Sustainability in IT (DLBSEPENIT01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Written Assessment: Case Study Study Format: Distance Learning Written Assessment: Case Study	

Weight of Module

see curriculum

Module Contents

- Introduction Ethics and Sustainability in IT
- Fundamentals of Ethics
- Establishment of Sustainable IT
- Social Sustainability
- Ecological Sustainability
- Ethical and Sustainable Issues in Case Studies

Learning Outcomes

Ethics and Sustainability in IT

On successful completion, students will be able to

- comprehend the motivation, solution approaches and challenges of sustainable information technology.
- understand the essential theories and concepts of building a sustainable information technology.
- understand the essential principles and methods for shaping the social and environmental dimensions of information technologies.
- comprehend the essential theories and concepts of ethics that are relevant to the critical reflection of ethical challenges needed in the context of information technologies including Artificial Intelligence.
- apply the knowledge acquired to analyze the social, environmental, and ethical challenges related to information technologies and develop responses to these.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Ethics and Sustainability in IT

Course Code: DLBSEPENIT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Sustainable management is playing an increasingly important role in business and society. Information Technologies (IT) also face the challenge of integrating ecological, social and ethical requirements in the development and use of systems. In this lecture, the main theories and concepts for building sustainable IT will be presented. After the general introduction, social, ecological and ethical basics and current examples are dealt with in depth, which can be used to discuss current issues and challenges.

Course Outcomes

On successful completion, students will be able to

- comprehend the motivation, solution approaches and challenges of sustainable information technology.
- understand the essential theories and concepts of building a sustainable information technology.
- understand the essential principles and methods for shaping the social and environmental dimensions of information technologies.
- comprehend the essential theories and concepts of ethics that are relevant to the critical reflection of ethical challenges needed in the context of information technologies including Artificial Intelligence.
- apply the knowledge acquired to analyze the social, environmental, and ethical challenges related to information technologies and develop responses to these.

Contents

1. Introduction to Ethics and Sustainability in IT
    - 1.1 Motivation, History and the Concept of Sustainability
    - 1.2 IT as a Problem and Solution for Sustainability
    - 1.3 Ethics in IT (Robot Laws According to Asimov)
2. Fundamentals of Ethics
    - 2.1 Overview: Ethics, Morals, and Social Norms
    - 2.2 Introduction of Ethical Paradigms (Utilitarianism, Virtue and Duty Ethics)
    - 2.3 Ethics Relevance for IT

3. Establishment of Sustainable IT
   - 3.1 Basics and Features
   - 3.2 Impact Cycle
   - 3.3 Measures and Implementation at the Process Level
   - 3.4 Measures Catalog for Green IT and IS

4. Social Sustainability
   - 4.1 Introduction to Human Rights, Data Protection and Privacy, and the Social Consequences of Digitalization
   - 4.2 Basics of the Data Protection Regulation
   - 4.3 Anonymization of Data Using k-Anonymity
   - 4.4 Cybersecurity as Part of Sustainable Business Management

5. Ecological Sustainability
   - 5.1 Introduction to Green Computing (Power Management, Cloud, Energy Savings, and Virtualization)
   - 5.2 Ecological Footprint and Trends in Information Technology
   - 5.3 The Circular Economy of Information Technology: Production, Usage and Recycling

6. Ethical and Sustainable Issues in Case Studies
   - 6.1 EU Guidelines for Trustworthy AI
   - 6.2 Bitcoin Mining and its CO2 Emissions
   - 6.3 Man or Machine – The Use of Big Data and AI in the Workplace
   - 6.4 Moral Machine Experiment: Moral Decisions of Machines Using the Example of Autonomous Driving
   - 6.5 Care Robotics in Japan

Literature
Compulsory Reading
Further Reading ▪ Beever, J./ McDaniel, R./ Stanlick, N.A. (2019): Understanding Digital Ethics: Cases and Contexts. 1st edition, Routledge, London. ▪ Cappiello C., Fugini M., Pernici B., Plebani P. (2011): Green Information Systems for Sustainable IT. In: D'Atri A., Ferrara M., George J., Spagnoletti P. (eds) Information Technology and Innovation Trends in Organizations. Physica-Verlag HD.Newton, L. (2013): Ethical Decision Making: Introduction to Cases and Concepts in Ethics. Springer Verlag, Wiesbaden. ▪ Curry, E./ Donnellan, B. (2014): Implementing sustainable IT strategy: the case of Intel. J Info Technol Teach Cases 4, 41–48. ▪ Lange, S./ Pohl, J./ Santarius, T. (2020): "Digitalization and energy consumption. Does ICT reduce energy demand?" Ecological Economics 176, Elsevier, Amsterdam.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Written Assessment: Case Study

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Written Assessment: Case Study

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

IT Project Management

Module Code: DLBCSEITPAM1

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Johannes Kent Walter (IT Project Management)

Contributing Courses to Module

- IT Project Management (DLBCSEITPAM01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes Study Format: myStudies Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Basic terms and foundations of IT project management
- Large and small planning techniques
- Techniques for prioritization, cost-estimation, and project controlling
- Techniques for stakeholder, communication, and risk management
- Organization and structure in IT project management
- Schools of thought in IT project management

Learning Outcomes

IT Project Management

On successful completion, students will be able to

- explain and differentiate between the basic principles and tasks of IT project management.
- explain the important practical techniques and methods necessary for the implementation of IT project management.
- describe the basic procedural models and explain their advantages and disadvantages as well as their possible applications.
- identify possible project risks on the basis of given practical scenarios and select suitable measures from IT project management in order to minimize them in a targeted manner.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

IT Project Management

Course Code: DLBCSEITPAM01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, typical problems in the management of Software projects are discussed and the methods and techniques used to address challenges conveyed.In addition, standard procedural models for IT project management are explained and their strengths and weaknesses specifically identified.

Course Outcomes

On successful completion, students will be able to

- explain and differentiate between the basic principles and tasks of IT project management.
- explain the important practical techniques and methods necessary for the implementation of IT project management.
- describe the basic procedural models and explain their advantages and disadvantages as well as their possible applications.
- identify possible project risks on the basis of given practical scenarios and select suitable measures from IT project management in order to minimize them in a targeted manner.

Contents

1. Basics Terms and Foundations of IT Project Management
   - 1.1 Definition of a Project and Types of IT Projects
   - 1.2 IT Project Lifecycle
   - 1.3 Multi-Project Management – The Project in the Context of the Organization
2. Planning Techniques
   - 2.1 Large-Scale Planning: Milestones, Sub-tasks, and Work Packages
   - 2.2 Large-Scale Planning: Gantt Charts
   - 2.3 Planning and Organization of Work Packages: Kanban Board
3. Prioritization, Estimation of Costs, Project Controlling
   - 3.1 Prioritization
   - 3.2 Estimation of Costs
   - 3.3 Project Controlling

4. Stakeholder, Communication and Risk Management
   - 4.1 Stakeholder Management
   - 4.2 Communication Management
   - 4.3 Risk Management

5. Organization and Structure in IT Project Management
   - 5.1 Overview and Levels of Management from PRINCE2
   - 5.2 Management Processes in PRINCE2
   - 5.3 Pragmatic IT Project Management (PITPM)
   - 5.4 Configuration of an IT Project in PITPM
   - 5.5 Management of a project in PITPM

6. Schools of Thought in IT Project Management
   - 6.1 Agile Software Development
   - 6.2 Value-Based Software Engineering

Literature

Compulsory Reading

Further Reading

- Project Management Institute. (2021). A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Seventh Edition and The Standard for Project Management (ENGLISH): Vol. Seventh edition. Project Management Institute.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Techniques and methods for agile software development

Module Code: IWNF1_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Jörn Fahsel (Techniques and methods for agile software development)

Contributing Courses to Module

- Techniques and methods for agile software development (IWNF01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Characteristics and Principles of Agility
- Agility in Small Teams with SCRUM
- Agile Project Management
- Agile Requirements and Software Architecture Management
- Agile Testing
- Agile Delivery and Deployment

Learning Outcomes

Techniques and methods for agile software development

On successful completion, students will be able to

- analyse and evaluate problems and risks of industrial SW development and their consequences for development processes.
- know and understand the basic principles of No-Frills Software Engineering.
- analyse practical scenarios and independently apply suitable methods and tools of No-Frills Software Engineering.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Techniques and methods for agile software development

Course Code: IWNF01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The goal of the course is to give students a deeper insight into the topic of agile software development. First of all, the basic characteristics and principles of agility are presented and discussed. Afterwards, it is shown how small projects and teams can use agile software engineering and how agile principles can be transferred and applied to large projects. Afterwards, agile techniques are taught for selected core activities in software engineering, with a focus on testing, delivery and deployment.

Course Outcomes

On successful completion, students will be able to

- analyse and evaluate problems and risks of industrial SW development and their consequences for development processes.
- know and understand the basic principles of No-Frills Software Engineering.
- analyse practical scenarios and independently apply suitable methods and tools of No-Frills Software Engineering.

Contents

1. Characteristics and Principles of Agility
   - 1.1 Features and Challenges of Software Projects
   - 1.2 Classification of Uncertainty
   - 1.3 Comparison of Agile and Classic Software Development
   - 1.4 Principles of Agility
2. Agility in Small Teams with Scrum
   - 2.1 Basics of SCRUM
   - 2.2 Central Management Artifact: Product Backlog
   - 2.3 Other Management Artifacts abd Tools
3. Agile Project Management
   - 3.1 Planning Levels in Agile Project Management

3.2 Agile Portfolio Management
3.3 Organization of Several Teams in One Project
3.4 Product and Release Planning

4. Agile Requirements and Software Architecture Management
4.1 Requirements Engineering in Agile Projects
4.2 Architecture Management in Agile Projects

5. Agile Testing
5.1 Basic Principles and Requirements for the Quality Assurance Organization
5.2 Test Levels and Agility
5.3 Test Automation

6. Agile Delivery and Deployment
6.1 Continuous Delivery Pipeline
6.2 Continuous Build and Continuous Integration
6.3 Acceptance Tests, Load Tests and Continuous Deployment

Literature

Compulsory Reading

Further Reading

- Biffl, S. et al. (Hrsg.) (2005): Value-Based Software Engineering. Springer, Berlin/Heidelberg.
- Highsmith, J. (2009): Agile Project Management: Creating Innovative Products. Addison Wesley, Upper Saddle River, NJ.
- Layton, M. C. (2012): Agile project management for dummies. John Wiley & Sons, New York, NY.
- Rubin, K. S. (2012): Essential Scrum: A Practical Guide to the Most Popular Agile Process. Addison Wesley, Upper Saddle River, NJ.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Mobile Software Engineering

Module Code: DLBCSEMSE1

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. jan Rüterbories (Mobile Software Engineering)

Contributing Courses to Module

- Mobile Software Engineering (DLBCSEMSE01)

Module Exam Type

Module Exam	Split Exam
Study Format: On Campus Exam, 90 Minutes Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Basics of Mobile Software Development
- Android System Architecture
- Development Environment
- Core Components of an Android App
- Interaction between Application Components
- Advanced Techniques

Learning Outcomes

Mobile Software Engineering

On successful completion, students will be able to

- recognize the differences and peculiarities of software development for mobile systems and explain them.
- differentiate between different activities, roles, and risks in the creation, operation, and maintenance of mobile software systems.
- explain and differentiate between the architecture and technical features of the Android platform.
- independently create mobile software systems to solve concrete problems for the “Android” platform.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Mobile Software Engineering

Course Code: DLBCSEMSE01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Using the mobile platform "Android" as an example, it will be demonstrated how the programming of mobile applications (apps) differs from the development of browser-based information systems, which technologies and programming concepts are typically used, and which typical challenges there are in app development for industrial applications.

Course Outcomes

On successful completion, students will be able to

- recognize the differences and peculiarities of software development for mobile systems and explain them.
- differentiate between different activities, roles, and risks in the creation, operation, and maintenance of mobile software systems.
- explain and differentiate between the architecture and technical features of the Android platform.
- independently create mobile software systems to solve concrete problems for the “Android” platform.

Contents

1. Basics of Mobile Software Development
   - 1.1 Special Features of Mobile Devices
   - 1.2 Special Features of Mobile Software Development
   - 1.3 Classification of Mobile Devices
   - 1.4 The Android Platform
2. Android System Architecture
   - 2.1 The Android System
   - 2.2 Safety and Security
   - 2.3 Communication with Networks
3. Development Environment
   - 3.1 Android Studio
   - 3.2 First App and Emulator Test

3.3 Application Deployment

4. Core Components of an Android App
   - 4.1 Overview of the Components of an Android App
   - 4.2 Activities, Layouts, and Views
   - 4.3 Resources
   - 4.4 Summary in an App
   - 4.5 Graphic Design

5. Interaction Between Application Components
   - 5.1 Intents
   - 5.2 Services
   - 5.3 Broadcast Receiver

6. Advanced Techniques
   - 6.1 Threading
   - 6.2 Application Memory

Literature

Compulsory Reading

Further Reading

- Allen, G. (2021). Android for absolute beginners: Getting started with mobile apps development using the Android Java SDK. Apress.
- Boyer, R., & Mew, K. (2016). Android application development cookbook (2nd ed.). Packt Publishing.
- Collins, L., & Ellis, R. S. (2015). Mobile devices: Tools and technologies. CRC Press.
- Hagos, T. (2020): Learn Android Studio 4: Efficient Java-Based Android Apps Development. Berkeley, CA: Apress.
- Meike, B. G., & Schiefer, L. (2022). Inside the Android OS: Building, customizing, managing, and operating Android system services. Pearson.

Study Format On Campus

Study Format	Course Type
On Campus	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods
Tutorial Support ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Seminar: Software Engineering

Module Code: ISSE_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Carsten Skerra (Seminar: Software Engineering)

Contributing Courses to Module

- Seminar: Software Engineering (ISSE01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Written Assessment: Research Essay Study Format: Distance Learning Written Assessment: Research Essay	

Weight of Module

see curriculum

Module Contents

The seminar deals with current topics in software engineering. Participants are required to formulate a research question pertaining to a selected topic and present the findings in the form of a written paper.

Learning Outcomes

Seminar: Software Engineering

On successful completion, students will be able to

- independently familiarize themselves with a given topic from the field of "Software Engineering".
- outline important characteristics, connections and findings in the form of a written assignment.
- present the results obtained in their independent work in the form of a written document.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fiels of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

Seminar: Software Engineering

Course Code: ISSE01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this seminar, students write a seminar paper on a specific topic and present their results. In this way, students demonstrate the ability to independently familiarize themselves with a software engineering topic and document and present the knowledge gained in a structured manner.

Course Outcomes

On successful completion, students will be able to

- independently familiarize themselves with a given topic from the field of "Software Engineering".
- outline important characteristics, connections and findings in the form of a written assignment.
- present the results obtained in their independent work in the form of a written document.

Contents

- The seminar deals with current topics in software engineering. Participants are required to formulate a research question pertaining to a selected topic and present the findings in the form of a written paper.

Literature

Compulsory Reading

Further Reading

- Ford, N. (2020): Fundamentals of Software Architecture: An Engineering Approach. A Comprehensive Guide to Patterns, Characteristics, and Best Practices. O'Reilly, Sebastopol, CA.
- Zobel, J. (2015): Writing for Computer Science. 3rd Edition, Springer, Berlin.

Study Format myStudies

Study Format	Course Type
myStudies	Seminar

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Research Essay

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Learning Material	**Exam Preparation**
☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Seminar

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Research Essay

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint	☑ Slides	☑ Guideline

4. Semester

Project: Agile Software Engineering

Module Code: IWNF2_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	None	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Martin Ejeagwu (Project: Agile Software Engineering)

Contributing Courses to Module

- Project: Agile Software Engineering (IWNF02_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Written Assessment: Project Report	

Weight of Module

see curriculum

Module Contents

Realization and documentation of projects using agile techniques as well as consolidation of selected topics in the field of agile software development.

Learning Outcomes **Project: Agile Software Engineering** On successful completion, students will be able to ▪ address typical problems in various project situations through the targeted use of agile techniques and methods. ▪ document the design and project-specific use of techniques and tools.	
Links to other Modules within the Study Program This module is similar to other modules in the field of Computer Science & Software Development	**Links to other Study Programs of the University** All Bachelor Programs in the IT & Technology field

Project: Agile Software Engineering

Course Code: IWNF02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	None

Course Description

Building on their knowledge of agile software development, students in this course independently implement projects in this subject area and document their results in the form of a written paper.

Course Outcomes

On successful completion, students will be able to

- address typical problems in various project situations through the targeted use of agile techniques and methods.
- document the design and project-specific use of techniques and tools.

Contents

- Implementation and documentation of a project using agile techniques as well as deepening of knowledge in the field of agile software development.

Literature

Compulsory Reading

Further Reading

- Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., & Thomas, D. (2001). Principles behind the Agile manifesto.
- Forsgren, N., Humble, J., & Kim, G. (2018) Accelerate: The Science Behind Devops: Building and Scaling High Performing Technology Organizations.
- Raps, S. J. (2017). Scrum of Scrums: Scaling up Agile to create efficiencies, reduce redundancies. Defense AT&L, 46(5), 34—37.
- Schwaber, K., & Sutherland, J. (2020). The Scrum guide. The definitive guide to Scrum: The rules of the game. Kenn Schwaber and Jeff Sutherland.
- Tanner, M., & Dauane, M. (2017). The use of Kanban to alleviate collaboration and communication challenges of global software development. Issues in Informing Science & Information Technology, 14, 177—197.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

IT Infrastructure

Module Code: DLBSEPITI_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Dr. Mohammad Shackow (IT Infrastructure)

Contributing Courses to Module

- IT Infrastructure (DLBSEPITI01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Fundamentals of Operating Systems
- Processes
- Data-Storage
- Virtualization
- Networks
- Remote Access
- Infrastructure Provisioning

Learning Outcomes

IT Infrastructure

On successful completion, students will be able to

- understand main aspects of the operation of computers.
- manipulate and manage computer operations using shells and more visual user-interfaces.
- understand, analyze and configure simple IP network structures.
- manipulate and manage basic orchestrated sets of containers.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

IT Infrastructure

Course Code: DLBSEPITI01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course describes the internal basic structure of computers and how they operate: Starting from the basic models of operating systems, the essential manipulation methods (shells and other user-interfaces) are structured and experimented. Networking basics are introduced far enough that they can be practiced. Contemporary network and virtualization structures and practices are explained so that students can experiment them on their own.

Course Outcomes

On successful completion, students will be able to

- understand main aspects of the operation of computers.
- manipulate and manage computer operations using shells and more visual user-interfaces.
- understand, analyze and configure simple IP network structures.
- manipulate and manage basic orchestrated sets of containers.

Contents

1. Fundamentals of Operating Systems
   - 1.1 The User, the Inventor, the Maker, the Developer and the Support
   - 1.2 Standard Ingredients
   - 1.3 Kernel, APIs, Application Programs
   - 1.4 WIMP
   - 1.5 REPL Shell
2. Processes
   - 2.1 Process-Scheduling, Traps and Threads
   - 2.2 Process-Management
   - 2.3 Process Security
3. Data-Storage
   - 3.1 Hard-Disk, Blocks, Formatting
   - 3.2 Files and their Manipulation
   - 3.3 Permissions of Files
   - 3.4 Data Pipes

3.5 Network Data Storage

4. Virtualization
   - 4.1 Concepts of Virtual Machines and Containers
   - 4.2 Virtual Machines
   - 4.3 Containers
   - 4.4 Sharing Resources

5. Networks
   - 5.1 Transmission Media, Commutation, Packet Switching
   - 5.2 TCP/IP and Related Communication Standards
   - 5.3 Web-Servers
   - 5.4 Public Key Cryptography
   - 5.5 Network Security

6. Remote Access
   - 6.1 Remote Shell
   - 6.2 Remote UI
   - 6.3 Web-Services
   - 6.4 Challenges of Distributed Computing

7. Infrastructure Provisioning
   - 7.1 Specification and Planning of Containers
   - 7.2 Orchestration of Containers
   - 7.3 Horizontal and Vertical Scaling
   - 7.4 Load-Testing and Monitoring

Literature

Compulsory Reading

Further Reading

- Albing, C., & Vossen, J. (2017). Bash cookbook (2nd ed.). O'Reilly.
- Grigorik, I. (2013). High performance browser networking. O'Reilly.
- Miell, I., & Sayers, I. A. (2016). Docker in practice. Manning Publications.
- Tanenbaum, A., & Bos, H. (2014). Modern operating systems (4th ed.). Pearson.
- Tanenbaum, A. (2010). Computer networks. Pearson.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Audio	☑ Online Tests
	☑ Slides	

IT Service Management

Module Code: DLBCSITSM-02

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. André Köhler (IT Service Management)

Contributing Courses to Module

- IT Service Management (DLBCSITSM01-02)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- IT Service Management Basics and Terms
- ITIL 4 - Basics and Four Dimensions
- ITIL 4 - Service Value System
- ITIL 4 - Principles
- ITIL 4 - Practices
- Information Security Management

Learning Outcomes **IT Service Management** On successful completion, students will be able to ▪ identify the fundamentals and challenges of IT service management. ▪ describe the motivation and structure of the IT Infrastructure Library (ITIL), distinguish four dimensions, apply the service value system and identify concrete practices. ▪ describe and apply fundamentals of IT security management.	
Links to other Modules within the Study Program This module is similar to other modules in the field of Computer Science & Software Development	**Links to other Study Programs of the University** All Bachelor Programs in the IT & Technology field

IT Service Management

Course Code: DLBCSITSM01-02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

IT service management is an approach to align and understand a company's IT as a service provider and supporter of operational and business processes. This course uses the IT Infrastructure Library (ITIL) to teach concepts, procedures and best practices in the area of IT service management (IT operations). In other words, it looks at the management of activities that take place after an IT system has been developed: IT operations as a continuous run of the productive day-to-day business of a company's IT departments.

Course Outcomes

On successful completion, students will be able to

- identify the fundamentals and challenges of IT service management.
- describe the motivation and structure of the IT Infrastructure Library (ITIL), distinguish four dimensions, apply the service value system and identify concrete practices.
- describe and apply fundamentals of IT security management.

Contents

1. IT Service Management Basics and Terms
   - 1.1 IT Services
   - 1.2 IT Service Management
   - 1.3 ITSM Frameworks
2. ITIL 4 - Basics and Four Dimensions
   - 2.1 Stakeholders, Services and Service Management
   - 2.2 Value Contribution of IT
3. ITIL 4 - Service Value System
   - 3.1 Basics and Overview
   - 3.2 Inputs, Outcome and Governance
   - 3.3 The Service Value Chain
   - 3.4 Continual Improvement
4. ITIL 4 - Principles

4.1 Overview
4.2 Value Orientation
4.3 Iterative Procedure and Feedback
4.4 Establish Collaboration and Visibility
4.5 Optimize and Automate

5. ITIL 4 - Practices
5.1 Overview
5.2 General Management Practices
5.3 Service Management Practices
5.4 Technical Practices

6. Information Security Management
6.1 Information Security Basics
6.2 Standards, Best Practices and Legal Requirements
6.3 Information Security Management with ISO/IEC 27001

Literature

Compulsory Reading

Further Reading

- Agutter, C. (2019). ITIL® foundation essentials ITIL 4 edition: The ultimate revision guide. ITGovernance Publishing.
- Axelos Limited. (2019). ITIL 4 foundation: ITIL 4 edition. The Stationery Office.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Project: Mobile Software Engineering

Module Code: DLBCSEMSE2

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Nils Kannengießer (Project: Mobile Software Engineering)

Contributing Courses to Module

- Project: Mobile Software Engineering (DLBCSEMSE02)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Written Assessment: Project Report Study Format: On Campus Written Assessment: Project Report Study Format: Distance Learning Written Assessment: Project Report	

Weight of Module

see curriculum

Module Contents

Conception, implementation, and documentation of small, mobile applications on the basis of a concrete task.

Learning Outcomes

Project: Mobile Software Engineering

On successful completion, students will be able to

- independently design and create a prototype of a small mobile application to solve a specific problem.
- recognize typical problems and challenges in the practical implementation of small mobile applications.
- document the conception and implementation of small, independently designed and implemented mobile applications.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Project: Mobile Software Engineering

Course Code: DLBCSEMSE02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Using the knowledge gained in the course "Mobile Software Engineering using the Android platform as an example", students independently create a mobile application and document its conception and implementation.

Course Outcomes

On successful completion, students will be able to

- independently design and create a prototype of a small mobile application to solve a specific problem.
- recognize typical problems and challenges in the practical implementation of small mobile applications.
- document the conception and implementation of small, independently designed and implemented mobile applications.

Contents

- Conception, implementation, and documentation of small, mobile applications on the basis of a concrete task. Possible topics are, for example:
- A radio app to improve the exchange between listeners and stations in general, and listeners and radio presenters in particular.
- An app that allows a group of board game fans to better organize their regular evening game.
- An app that theses supervisors at IUBH can use to improve their supervision processes.

Literature

Compulsory Reading

Further Reading

- Allen, G. (2021): Android for Absolute Beginners [electronic resource]: Getting Started with Mobile Apps Development Using the Android Java SDK. Berkeley, CA: Apress.
- Boyer, R. & Mew, K. (2016): Android Application Development Cookbook - Second Edition. Birmingham, UK : Packt Publishing.
- Hagos, T. (2020): Learn Android Studio 4: Efficient Java-Based Android Apps Development. Berkeley, CA: Apress.

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format On Campus

Study Format	Course Type
On Campus	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Project: Cloud Programming

Module Code: DLBSEPCP_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	None	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Georgi Dimchev (Project: Cloud Programming)

Contributing Courses to Module

- Project: Cloud Programming (DLBSEPCP01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio Study Format: myStudies Portfolio	

Weight of Module

see curriculum

Module Contents

The students employ and polish their knowledge of distributed computer systems so as to be able to plan, create, test, and document a scalable service deployed in the cloud. The module is focused on a practical realization and its documentation: Through the testable deployment, students guarantee that their project can be realized and has requirements of a cloud system, through the documentation, the student demonstrates the qualities of the realization and of its creation process.

Learning Outcomes

Project: Cloud Programming

On successful completion, students will be able to

- associate characteristics of a cloud infrastructure as discussed in business with concrete implications for the machines deployed in the cloud.
- create a plan for a chosen cloud infrastructure provider and measure the achievement of this plan.
- specify by means of scripts, programs, documented web-platform usage, how the elements of a cloud service are created and measured.
- describe the risks, the protection measures, and the reaction measures of a cloud-service.
- demonstrate a running cloud-service created by the student and allow it to be tested in all its possible usage dimensions.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Project: Cloud Programming

Course Code: DLBSEPCP01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	None

Course Description

The usage of commodity computing in the form of a service offered over a network interface is a major technical aspect of services made by IT organizations: The services function within a server environment and the ubiquity of the network make the service reachable from everywhere with high availability guarantees and flexible scalability. The course aims at a documented realization of a cloud service which displays all the attributes of a cloud service. In doing so the students employ and deepen their knowledge of distributed computer systems so as to be able to plan, create, deploy, test, measure, and document a scalable service in the cloud.

Course Outcomes

On successful completion, students will be able to

- associate characteristics of a cloud infrastructure as discussed in business with concrete implications for the machines deployed in the cloud.
- create a plan for a chosen cloud infrastructure provider and measure the achievement of this plan.
- specify by means of scripts, programs, documented web-platform usage, how the elements of a cloud service are created and measured.
- describe the risks, the protection measures, and the reaction measures of a cloud-service.
- demonstrate a running cloud-service created by the student and allow it to be tested in all its possible usage dimensions.

Contents

- In this course, students create a cloud service which demonstrates the core aspects of cloud service programming by an explicit documentation and by a measurable concrete realization. To do so, they choose a PaaS cloud service hoster, set-up a service, describe its interfaces (API) and how the core characteristics of cloud services are achieved:
  - Horizontal or vertical scalability: How the service can be enlarged or diminished in its usage of resources in order to react to variation to the demand.
  - High-availability: What guarantees a failover in case a component of the service is made inoperable and what kind of degradation can happen.
  - Measurability: How the usage of resources is measured and how these measures can allow a proactive planning.
  - Orchestration and provisioning: How the service is deployed and changes in its resources allocations are performed as needed by the usage of the service.

The cloud service should be testable and demonstratable by external users; a plan how to test it should be part of the documentation including the dimensions of the usage as well as the API definitions of the service. The service should fulfill a recognizable business need and be documented by an API definition and a user-interface for its usage runnable on any platform that has access to the internet. Being a service on the internet, its security restrictions should be accessible and understandable. Based on these ingredients, the students realize a work in the form of software artifacts in a versioning system and a human readable documentation of the realization and its process. The realization and its documentation should follow current trends in cloud engineering.

Literature

Compulsory Reading

Further Reading

- Johnston, C., Advanced Platform Development with Kubernetes. Springer,
- Jonas, E., Schleier-Smith, J., Sreekanti , V., Tsai, C.-c., Khandelwal ,A., Pu, Q., Shankar, V., Carreira, J., Krauth, K., Jayant Yadwadkar, N., Gonzalez, J., Popa, R.A., Stoica, I., Patterson, D.: Cloud Programming Simplified: A Berkeley View on Serverless Computing. CoRR abs/1902.03383 (2019)
- Talia, D., A view of programming scalable data analysis: from clouds to exascale, Journal of Cloud Computing: Advances, Systems and Applications (2019-02-01).
- Ponelat, J.S., Rosenstock, L.L., Designing APIs with Swagger and OpenAPI, Manning Publications, ISBN 9781617296284,

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Introduction to Data Protection and Cyber Security

Module Code: DLBCSIDPITS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Ralf Kneuper (Introduction to Data Protection and Cyber Security)

Contributing Courses to Module

- Introduction to Data Protection and Cyber Security (DLBCSIDPITS01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Fundamentals of IT Security
- Data Protection
- IT Security Management
- Network and Communication Security

Learning Outcomes

Introduction to Data Protection and Cyber Security

On successful completion, students will be able to

- explain the terms and concepts of IT security and know the typical procedures and techniques which exist in each area.
- cite the legal regulations on data protection and explain their implementation.
- discuss in-depth IT security management and suitable measures for implementation.
- use their overview knowledge of activities and strategies for IT security in software and system development.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Introduction to Data Protection and Cyber Security

Course Code: DLBCSIDPITS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, the students are familiarized with important concepts from the field of IT security. Basic terms are introduced and discussed, and typical application fields, areas of IT security application, and typical procedures and techniques are introduced and described.

Course Outcomes

On successful completion, students will be able to

- explain the terms and concepts of IT security and know the typical procedures and techniques which exist in each area.
- cite the legal regulations on data protection and explain their implementation.
- discuss in-depth IT security management and suitable measures for implementation.
- use their overview knowledge of activities and strategies for IT security in software and system development.

Contents

1. Fundamentals of Data Protection and Cyber Security
   - 1.1 Conceptual Bases, Protection Goals
   - 1.2 Attacks and Threats
   - 1.3 Security Strategy
   - 1.4 Legal Regulations
2. Data Protection
   - 2.1 Data Protection as a Personal Right
   - 2.2 Basic Principles of Data Protection
   - 2.3 EU General Data Protection Regulation
   - 2.4 Further International Regulations on Data Protection
   - 2.5 Cross-Border Data Flow
   - 2.6 Data Protection in Everyday Life
3. Basic Functions of Cyber Security and Their Implementation
   - 3.1 Identification and Authentication
   - 3.2 Rights Management

3.3 Rights Check
3.4 Preservation of Evidence

4. Cyber Security Management
   4.1 Basic Concepts and Standards in Cyber Security Management
   4.2 Series of Standards ISO 2700x

5. Cyber Security Management in Everyday Life
   5.1 Password Management
   5.2 Data Backup
   5.3 Email Security
   5.4 Protection Against Viruses and Other Malware
   5.5 Protection Against Social Engineering Attacks

6. Network and Communication Security
   6.1 Firewall Technology
   6.2 Network Separation
   6.3 Security in WLAN, Mobile Networks, Bluetooth, and NFC

7. Cyber Security in the Development of Software and Systems
   7.1 Protection of the Development Environment
   7.2 Secure Development
   7.3 Common Criteria

Literature

Compulsory Reading

Further Reading

- Arnold, R. (2017). Cybersecurity: A business solution. An executive perspective on managing cyber risk. Threat Sketch.
- European Parliament and Council of the European Union. (2016). EU General Data Protection Regulation (GDPR): Regulation 2016/679 of the European Parliament and of the council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Official Journal of the European Union. Chapters 1—3 .
- Mattord, H., & Whitman, M. (2017). Management of information security. Cengage.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

5. Semester

DevOps and Continuous Delivery

Module Code: DLBSEPDOCD_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Tianxiang Lu (DevOps and Continuous Delivery)

Contributing Courses to Module

- DevOps and Continuous Delivery (DLBSEPDOCD01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Written Assessment: Case Study	

Weight of Module

see curriculum

Module Contents

- The DevOps Approach
- Service Architectures
- DevOps Environment
- Continuous Integration and Deployment
- Automated Testing
- Information Security in DevOps

Learning Outcomes

DevOps and Continuous Delivery

On successful completion, students will be able to

- discuss key aspects of DevOps culture,
- apply hands-on experience with techniques related to DevOps and continuous deployment,
- create, configure and deploy platform as a service container,
- manage (micro-)service architectures using platform as a service technique,
- construct and maintain a continuous deployment pipeline to develop and deploy an application iteratively and incrementally.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

DevOps and Continuous Delivery

Course Code: DLBSEPDOCD01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

When developing modern applications from scratch, emerging approaches like microservice architectures, agile techniques and virtualization are becoming important. Agile development stands for very quick releases of small software increments. Since important recurring tasks for each release like testing, configuration and deployment are time-consuming, a highly automated software development and deployment process is required. As well, development and deployment more and more becomes one single task, triggered by a single code commit. Implementing a fully automated continuous delivery pipeline and putting development and operations into one DevOps team holistically responsible for one microservice are essential for modern software development. In this course, both approaches are introduced with a strong focus on tool practice.

Course Outcomes

On successful completion, students will be able to

- discuss key aspects of DevOps culture,
- apply hands-on experience with techniques related to DevOps and continuous deployment,
- create, configure and deploy platform as a service container,
- manage (micro-)service architectures using platform as a service technique,
- construct and maintain a continuous deployment pipeline to develop and deploy an application iteratively and incrementally.

Contents

1. The DevOps Approach
   - 1.1 Issues in Classic Approaches
   - 1.2 Goals of DevOps
   - 1.3 DevOps Case Studies
   - 1.4 DevSecOps
2. Mikroservice Architectures
   - 2.1 Microservice
   - 2.2 Domain-Driven Design
   - 2.3 Containerization and Platform as a Service
   - 2.4 Practical Examples

3. DevOps Environment
   - 3.1 Version Control Concepts
   - 3.2 Version Control Tools
   - 3.3 Code Repositories
   - 3.4 Package Manager
   - 3.5 Virtualization

4. Continuous Integration and Deployment
   - 4.1 Continuous Delivery Pipeline
   - 4.2 Build Tools
   - 4.3 CI/CD Engines and Server
   - 4.4 Configuration Management and Infrastructure as Code

5. Automated Testing
   - 5.1 Basic Concepts
   - 5.2 Static Analysis Tools
   - 5.3 Unit Testing Tools
   - 5.4 UI and Acceptance Tests Tools
   - 5.5 Performance Testing Tools

6. Information Security in DevOps
   - 6.1 Roles and Responsibilities
   - 6.2 Change Management

Literature

Compulsory Reading

Further Reading

- Chatley, R., & Procaccini, I. (2020). Threading DevOps Practices through a University Software Engineering Programme. In 2020 IEEE 32nd Conference on Software Engineering Education and Training (CSEE&T) (pp. 1–5). IEEE.
- Farcic, V. (2016). The DevOps 2.0 Toolkit. Packt Publishing.
- Hills, M. (2020). Introducing DevOps Techniques in a Software Construction Class. In 2020 IEEE 32nd Conference on Software Engineering Education and Training (CSEE&T) (pp. 1–5). IEEE.
- Kim, G., Humble, J., Debois, P., & Willis, J. (2016). The DevOps Handbook: How to create world-class agility, reliability, and security in technology organizations. IT Revolution Press.
- Leszo, R. (2019). Continuous Delivery with Docker and Jenkins: Create secure applications by building complete CI/CD pipelines (2nd ed.). Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Written Assessment: Case Study

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

User Interface Design and Ergonomics

Module Code: DLBMIUID1_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	None	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Tim Heiler (User Interface Design and Ergonomics)

Contributing Courses to Module

- User Interface Design and Ergonomics (DLBMIUID01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Introduction, Terms, Basics
- Human-Centered Design Process
- Information Architecture
- User Interface Design Elements
- Responsive User Interfaces
- Usability

Learning Outcomes

User Interface Design and Ergonomics

On successful completion, students will be able to

- name and describe central concepts for the design of user interfaces and apply the basic principles of the design process.
- describe the benefits and use of information architectures for the design of user
- interface and create macro- and micro-information architectures.
- name and describe the design elements of user interfaces.
- name, describe and delimit the central concepts for responsive user interfaces.
- explain the terms usability and accessibility, represent their relation to the
- design of user interfaces and apply important concepts from those terms in the design of user interfaces.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

User Interface Design and Ergonomics

Course Code: DLBMIUID01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	None

Course Description

In this course, fundamentals and important concepts for the design of user interfaces are presented and discussed. Here, a focus is placed on web and mobile UIs. After a brief introduction to the topic of UI design and ergonomics, the general flow of UI design processes will be presented and discussed. Then the concept of information architecture will be introduced, which is an essential model for structuring the content of UIs. Thereafter typical design elements in UIs will be presented and described. This is followed by the topic of designing responsive user interfaces. The topics of usability and accessibility conclude this course.

Course Outcomes

On successful completion, students will be able to

- name and describe central concepts for the design of user interfaces and apply the basic principles of the design process.
- describe the benefits and use of information architectures for the design of user
- interface and create macro- and micro-information architectures.
- name and describe the design elements of user interfaces.
- name, describe and delimit the central concepts for responsive user interfaces.
- explain the terms usability and accessibility, represent their relation to the
- design of user interfaces and apply important concepts from those terms in the design of user interfaces.

Contents

1. Introduction, Terms, Basics
    - 1.1 Clarification of Terms: User Interface, Ergonomics, Usability
    - 1.2 Types of User Interfaces
    - 1.3 Challenges in the Design of User Interfaces
    - 1.4 Standards and Guidelines

2. Human-Centered Design Process
    - 2.1 Human-Centered Design Process
    - 2.2 Cooperative, Iterative Approach
    - 2.3 Requirements and Target Groups
    - 2.4 Prototyping and Evaluations

2.5 Double-Diamond-Design-Model

3. Information Architecture
   - 3.1 Types of Websites
   - 3.2 Macro Information Architecture
   - 3.3 Micro Information Architecture

4. Design Elements of User Interfaces
   - 4.1 Navigation Elements
   - 4.2 Search Function
   - 4.3 Page Design
   - 4.4 Accessibility

5. Responsive User Interfaces
   - 5.1 Basics, Principles, Challenges
   - 5.2 Layout Types, Grid Systems, Breakpoints
   - 5.3 Media Queries
   - 5.4 Layout Patterns

Literature

Compulsory Reading

Further Reading

- Grant, Will. 2018. 101 UX Principles : A Definitive Design Guide. Expert Insight. Birmingham: Packt Publishing.
- Mayhew, Deborah J. 2010. The usability engineering lifecycle: A practitioner's handbook for user interface design. San Francisco: Morgan Kaufmann.
- Peterson, Clarissa. 2014. Learning responsive web design: a beginner's guide. Sebastopol: O'Reilly.
- Rosenfeld, Louis, Jorge Arango, und Peter Morville. 2015. Information architecture: for the Web and beyond. 4. Sebastopol: O'Reilly.
- Stone, Deborah L. und Open University. 2005. User interface design and evaluation. San Francisco: Morgan Kaufmann.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Introduction to Programming with Python

Module Code: DLBDSIPWP

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Yan Zhu (Introduction to Programming with Python)

Contributing Courses to Module

- Introduction to Programming with Python (DLBDSIPWP01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam, 90 Minutes Study Format: Distance Learning Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Python as a programming language for data science
- Variables and built-in datatypes
- Statements and functions
- Error and exception handling
- Important Python data science modules

Learning Outcomes

Introduction to Programming with Python

On successful completion, students will be able to

- use fundamental Python syntax.
- recollect common elementary data types.
- recognize foundational programming concepts and their realization in Python.
- understand error handling and logging.
- create working programs.
- list the most important libraries and packages for data science.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

Introduction to Programming with Python

Course Code: DLBDSIPWP01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course provides students with a foundational understanding of the Python programming language. Following an introductory exposition to the importance of Python for data science-related programming tasks, students will be acquainted with fundamental programming concepts like variables, data types, and statements. Building on this basis, the important notion of a function is explained and errors, exception handling, and logging are explicated. The course concludes with an overview of the most widely-used library packages for data science.

Course Outcomes

On successful completion, students will be able to

- use fundamental Python syntax.
- recollect common elementary data types.
- recognize foundational programming concepts and their realization in Python.
- understand error handling and logging.
- create working programs.
- list the most important libraries and packages for data science.

Contents

1. Introduction
   - 1.1 Why Python?
   - 1.2 Obtaining and installing Python
   - 1.3 The Python interpreter , IPython, and Jupyter
2. Variables and Data Types
   - 2.1 Variables and value assignment
   - 2.2 Numbers
   - 2.3 Strings
   - 2.4 Collections
   - 2.5 Files
3. Statements
   - 3.1 Assignment, expressions, and print

3.2 Conditional statements
3.3 Loops
3.4 Iterators and comprehensions

4. Functions
   4.1 Function declaration
   4.2 Scope
   4.3 Arguments

5. Errors and Exceptions
   5.1 Errors
   5.2 Exception handling
   5.3 Logs

6. Modules and Packages
   6.1 Usage
   6.2 Namespaces
   6.3 Documentation
   6.4 Popular data science packages

Literature

Compulsory Reading

Further Reading

- Barry, P. (2016). Head first Python: A brain-friendly guide. O'Reilly Media, Inc.
- Kapil, S. (2019). Clean Python: Elegant coding in Python. Apress.
- Lubanovic, B. (2019). Introducing Python (2nd ed.). O'Reilly.
- Lutz, M. (2013). Learning Python (5th ed.). O'Reilly.
- Matthes, E. (2015). Python crash course: A hands-on, project-based introduction to programming. No Starch Press.
- Müller, A. C., & Guido, S. (2016). Introduction to machine learning with Python: A guide for data scientists. O'Reilly Media, Inc.
- Ramalho, L. (2015). Fluent Python: Clear, concise, and effective programming. O'Reilly.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Project: Software Development

Module Code: DLBSEPPSD_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Thorsten Fröhlich (Project: Software Development)

Contributing Courses to Module

- Project: Software Development (DLBSEPPSD01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Oral Project Report	

Weight of Module

see curriculum

Module Contents

The Software Development Project offers students the opportunity to gain practical experience in the field of software development based on the subject-specific study components. For this purpose, any kind of software is to be implemented, for example a comprehensive mobile or web app, or a set of cloud-hosted microservices that together fulfill a complex business need. However, the software should be able to solve a relevant problem from practice, either way.

Learning Outcomes

Project: Software Development

On successful completion, students will be able to

- identify relevant problems from the professional environment of software developer and explain them to an interested audience,
- apply established procedures to find a software-based solution to the problem,
- find relevant technologies, programming languages and software libraries for the solution and deploy them on any suitable infrastructure,
- evaluate the result in terms of its suitability for solving the practical problem,
- present the problem, the solution and the way to get there in a comprehensible and descriptive way.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Project: Software Development

Course Code: DLBSEPPSD01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In the course of the studies, a variety of different concepts, methods and techniques were introduced that are relevant to the professional practice of a software developer. This project offers the opportunity to use the accumulated knowledge and skills to solve a relevant practical problem independently and on one's own responsibility. The result should be a software that has been fully implemented, tested and that is deployable. The software shall profoundly demonstrate how the practical problem can be solved. The result has to be made available as open source to other students and to the tutor on a platform provided for this purpose.

Course Outcomes

On successful completion, students will be able to

- identify relevant problems from the professional environment of software developer and explain them to an interested audience,
- apply established procedures to find a software-based solution to the problem,
- find relevant technologies, programming languages and software libraries for the solution and deploy them on any suitable infrastructure,
- evaluate the result in terms of its suitability for solving the practical problem,
- present the problem, the solution and the way to get there in a comprehensible and descriptive way.

Contents

- At the beginning of the project the students choose a concrete task in coordination with the tutor. The task shall be derived from a relevant practical problem. Possible problems and use cases can be found in any industry from insurance to healthcare. Problems are also found in cross-sectional topics like, for example, in the areas of smart services, smart home, business information systems, artificial intelligence, sustainability, accessibility, data analytics or robotic process automation. The solution approach can consider mobile apps, web apps, web services, microservices, embedded software or even batch jobs hosted on mainframes. Students work on the task with the help of an integrated development environment that fits the subject of the task. The environment is intended to focus on software (e.g. technology-specific development environments such as Eclipse IDE, Android Studio or matlab) but can also be extended to hardware environment (e.g. prototyping boards such as the Arduino). To complete the task, students apply the concepts, methods

and tools taught throughout the curriculum. The result is evaluated in terms of its suitability to solve the previously selected problem. Aspects such as complexity, creativity and practical relevance play a role.

Literature

Compulsory Reading

Further Reading

- Newman, S. (2015): Building microservices: designing fine-grained systems. O'Really, Sebastopol, California.
- Thomas, D., & Hunt, A. (2020): The pragmatic programmer: your journey to mastery. 2nd Edition, Addison-Wesley, Boston.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Oral Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Learning Material	**Exam Preparation**
☑ Slides	☑ Online Tests
	☑ Guideline

Mathematics Basics

Module Code: DLBSEWMG_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Veronica Mas (Mathematics I) / Dr. Annika Denkert (Mathematics II)

Contributing Courses to Module

- Mathematics I (DLBCSM101)
- Mathematics II (DLBCSM201)

Module Exam Type

Module Exam	Split Exam
	Mathematics I • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes Mathematics II • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Mathematics I

- Basic Definitions and Terms of Discrete Mathematics
- Sets and Propositional Logic
- Number Systems such as Decimal and Binary Systems
- Graphs and Mappings
- Selected Topics of Elementary Number Theory
- Cryptography

Mathematics II

- Selected Topics of Linear Algebra
- Selected Chapters on Graphs and Algorithms

Learning Outcomes

Mathematics I

On successful completion, students will be able to

- understand basic terms of discrete mathematics as well as describe them and distinguish them from each other.
- understand concepts of number theory and their application in IT and technology and be able to solve tasks independently by applying these concepts.

Mathematics II

On successful completion, students will be able to

- understand basic concepts of linear algebra, their interrelations, and their application in IT and technology and be able solve tasks independently using these concepts.
- understand and distinguish the basic concepts and important algorithms for graphs and trees from the field of discrete mathematics as well as their application in IT and technology.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Methods.	All Bachelor Programmes in the Business & Management field.

Mathematics I

Course Code: DLBCSM101

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Many practical concepts in IT and technology are based on the findings of discrete mathematics. For an in-depth understanding of, for example, data structures, the construction of communication networks, or of solutions to algorithmic problems, a basic understanding of their mathematical background is necessary. This course therefore introduces discrete mathematical terms and concepts, with specific areas of number theory also taught.

Course Outcomes

On successful completion, students will be able to

- understand basic terms of discrete mathematics as well as describe them and distinguish them from each other.
- understand concepts of number theory and their application in IT and technology and be able to solve tasks independently by applying these concepts.

Contents

1. Mathematical Basics
   - 1.1 Basic Concepts
   - 1.2 Proof Techniques
   - 1.3 Finite Sums
2. Sets
   - 2.1 Properties and Calculation Rules for Sets
   - 2.2 Equivalence Relations
3. Propositional Logic
   - 3.1 Statements and Logical Connections
   - 3.2 Truth Tables
   - 3.3 Computational Rules of Propositional Logic
   - 3.4 Simplification of Expressions in Propositional Logic
4. Number Systems
   - 4.1 Decimal System

- 4.2 Binary System
- 4.3 Hexadecimal System

5. Mappings
   - 5.1 Mappings and Graphs
   - 5.2 Special Properties of Mappings
6. Basic Algebraic Structures
   - 6.1 Groups
   - 6.2 Rings
   - 6.3 Residual Class Rings
7. Prime Numbers
   - 7.1 Definition and Properties of Prime Numbers
   - 7.2 Prime Number Test
8. Modular Arithmetic
   - 8.1 The Euclidean Algorithm
   - 8.2 Fundamental Theorem of Arithmetic
9. Applications in Cryptography
   - 9.1 The Shift Cryptosystem
   - 9.2 Symmetric vs Asymmetric Cryptosystems
   - 9.3 The RSA Cryptosystem

Literature

Compulsory Reading

Further Reading

- Rosenthal, D., Rosenthal, D., Rosenthal, P. (2018). A Readable Introduction to Real Mathematics (2nd ed.). Springer.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Audio	☑ Online Tests
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Mathematics II

Course Code: DLBCSM201

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course continues the introduction to topics of discrete mathematics which began in the module "Mathematics Fundamentals I". In this course, the concepts of linear algebra are introduced and knowledge about graphs and algorithms for graphs is deepened. Typical questions of applied computer science are selected, and students are shown how they can be solved with graphs.

Course Outcomes

On successful completion, students will be able to

- understand basic concepts of linear algebra, their interrelations, and their application in IT and technology and be able solve tasks independently using these concepts.
- understand and distinguish the basic concepts and important algorithms for graphs and trees from the field of discrete mathematics as well as their application in IT and technology.

Contents

1. Introduction to Matrices
   - 1.1 Basic Concepts of Matrices
   - 1.2 Addition of Matrices
   - 1.3 Scalar Multiplication and Product
2. Inverting Matrices
   - 2.1 Multiplication of Matrices
   - 2.2 Properties of Matrix Multiplication
   - 2.3 Inverse Matrices
3. Linear Systems of Equations
   - 3.1 Gauss Algorithm
   - 3.2 Example Applications of the Gaussian Algorithm
4. Introduction to Graphs
   - 4.1 Undirected Graphs
   - 4.2 Further Properties of Graphs

4.3 Adjacency Matrix

5. The Problem of the Shortest Routes
   - 5.1 Directional Graph or Digraph
   - 5.2 Weighted Graph
   - 5.3 Dijkstra's Algorithm

6. The Königsberg Bridge Problem
   - 6.1 Routing in Graphs
   - 6.2 Eulerian Graph
   - 6.3 Hierholzer's Algorithm
   - 6.4 The Postman Problem

7. A City Tour Where Each City is Visited Exactly Once.
   - 7.1 Special Graphs
   - 7.2 Hamiltonian Graph
   - 7.3 The Ore and Dirac Condition
   - 7.4 The Problem of the Traveling Salesman

8. Trees
   - 8.1 Properties of Trees
   - 8.2 Root Tree
   - 8.3 Spanning Tree
   - 8.4 Minimal Spanning Tree

Literature

Compulsory Reading

Further Reading

- Benjamin, A., Chartrand, G., and Zhang, P. (2017). The fascinating world of graph theory. Princeton University Press.
- Erciyes, J. (2021). Discrete mathematics and graph theory: A concise study companion and guide. Princeton University Press.
- Lewis, H., & Zax, R. (2019). Essential discrete mathematics for computer science. Princeton University Press.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Mathematics: Linear Algebra and Analysis

Module Code: DLBSEWMLAA_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Robert Graf (Mathematics: Linear Algebra) / Prof. Dr. Robert Graf (Mathematics: Analysis)

Contributing Courses to Module

- Mathematics: Linear Algebra (DLBDSMFLA01)
- Mathematics: Analysis (DLBDSMFC01)

Module Exam Type

Module Exam	Split Exam
	Mathematics: Linear Algebra • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Mathematics: Analysis • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Mathematics: Linear Algebra

- Matrix Algebra
- Vector Spaces
- Linear and Affine Transformations
- Analytical Geometry
- Matrix Decomposition

Mathematics: Analysis

- Sequences and Series
- Functions and Reverse Functions
- Differential Calculus
- Integral Calculus

Learning Outcomes

Mathematics: Linear Algebra

On successful completion, students will be able to

- explain fundamental notions in the domain of linear equation systems.
- exemplify properties of vectors and vector spaces.
- summarize characteristics of linear and affine mappings.
- identify important relations in analytical geometry.
- utilize different methods for matrix decomposition.

Mathematics: Analysis

On successful completion, students will be able to

- summarize the basic concepts of analysis.
- illustrate the terms "sequences" and "series".
- explain the concept of a function and determine the inverse function where possible.
- compute derivatives and integrals using the standard rules of differentiation and integration.
- explain the relationship between differentiation and integration.
- solve simple linear differential equations.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Methods.	All Bachelor Programmes in the Business & Management field.

Mathematics: Linear Algebra

Course Code: DLBDSMFLA01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Linear algebra is a fundamental subject in mathematics. Its historical origin lies in the development of solution techniques for systems of linear equations arising from geometric problems. Numerous scientific and engineering applications can be solved using its methods. This course introduces the foundations of linear algebra and its basic notions like vectors and matrices. It then builds upon this foundation by introducing the derivation of solution techniques for problems in analytical geometry.

Course Outcomes

On successful completion, students will be able to

- explain fundamental notions in the domain of linear equation systems.
- exemplify properties of vectors and vector spaces.
- summarize characteristics of linear and affine mappings.
- identify important relations in analytical geometry.
- utilize different methods for matrix decomposition.

Contents

1. Foundations
   - 1.1 Systems of Linear Equations
   - 1.2 Matrices: Basic Terms
   - 1.3 Matrix algebra
   - 1.4 Matrices as compact representations of linear equations
   - 1.5 Inverse and trace
2. Vector Spaces
   - 2.1 Definition
   - 2.2 Linear Combination and Linear Dependance
   - 2.3 Basis, Linear Envelope, and Rank
3. Linear and Affine Mapping
   - 3.1 Matrix Representation of Linear Mappings
   - 3.2 Image and Kernel

3.3 Affine Spaces and Subspaces
3.4 Affine Mapping

4. Analytical Geometry
   4.1 Norm
   4.2 Scalar Product
   4.3 Orthogonal Projections
   4.4 Outlook: Complex Numbers

5. Matrix Decomposition
   5.1 Determinant
   5.2 Eigenvalues and Eigenvectors
   5.3 Cholesky Decomposition
   5.4 Eigenvalue Decomposition and Diagonalisation
   5.5 Singular Value Decomposition

Literature

Compulsory Reading

Further Reading

- Aggarwal, C.C. (2020). Linear Algebra and Optimization for Machine Learning: A Textbook. Springer.
- Mathai, A. M., & Haubold, H. J. (2017). Linear algebra, a course for physicists and engineers (1st ed.) De Gruyter.
- Neri, F. (2019). Linear algebra for computational sciences and engineering (2nd ed.) Springer.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Mathematics: Analysis

Course Code: DLBDSMFC01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Analysis is one of the essential basic subjects of mathematics. Originally developed to be able to formulate and solve problems of classical mechanics mathematically, in its present rigorous form it has become indispensable in numerous applications in the natural sciences and technology. This module aims to introduce the basic tool of differential and integral calculus and to explain their mutual interrelations. In addition, the concept of differential equations is explained and corresponding solution methods are discussed for simple cases.

Course Outcomes

On successful completion, students will be able to

- summarize the basic concepts of analysis.
- illustrate the terms "sequences" and "series".
- explain the concept of a function and determine the inverse function where possible.
- compute derivatives and integrals using the standard rules of differentiation and integration.
- explain the relationship between differentiation and integration.
- solve simple linear differential equations.

Contents

1. Sequences and Series
   - 1.1 Sequences: Convergence and Monotony
   - 1.2 Definition and Convergence
   - 1.3 Specific Sequences and Series
2. Functions and Inverse Functions
   - 2.1 Functions and Their Properties
   - 2.2 Exponential and Logarithmic Functions
   - 2.3 Trigonometric Functions
3. Differential Calculus
   - 3.1 First Derivative and Power Rule
   - 3.2 Differentiation Rules and Higher Derivatives
   - 3.3 Taylor Series and Taylor Polynomial

3.4 Curve Sketching
3.5 Outlook: Partial Derivatives

4. Integral Calculus
   4.1 The Indefinite Integral and Integration Rules
   4.2 The Definite Integral and the Fundamental Theorem of Calculus
   4.3 Volume and Lateral Surface of Solids of Revolution and Arc Length

5. Differential Equations
   5.1 Introduction and Basic Terms
   5.2 Solution of First-Order Linear Homogeneous Differential Equations
   5.3 Solution of First-Order Linear Non-Homogeneous Differential Equations
   5.4 Outlook: Partial Differential Equations

Literature

Compulsory Reading

Further Reading

- HELM Project (n.d.). Helping Engineers Learn Mathematics: 50 Workbooks. Available Online.
- Magnus, R. (2020). Fundamental Mathematical Analysis. Springer International Publishing.
- Pal Srimanta, & Bhunia Subodh C. (2015). Engineering Mathematics. Oxford University Press.
- Sydsæter, K., Hammond, P., Strom, A., & Carvajal, A. (2016). Essential mathematics for economic analysis (Fifth edition). Pearson Education.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Statistics Basics

Module Code: DLBSEWSG-02_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum		BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Veronica Mas (Statistics: Probability and Descriptive Statistics) / Hashem Zarafat (Statistics - Inferential Statistics)

Contributing Courses to Module

- Statistics: Probability and Descriptive Statistics (DLBDSSPDS01-01)
- Statistics - Inferential Statistics (DLBDSSIS01-01)

Module Exam Type

Module Exam	Split Exam
	Statistics: Probability and Descriptive Statistics • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Statistics - Inferential Statistics • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Statistics: Probability and Descriptive Statistics

- Probability
- Random Variables
- Joint Distributions
- Expectation and Variance
- Inequalities and Limit Theorems

Statistics - Inferential Statistics

- Point Estimation
- Uncertainties
- Bayesian Inference & Non-Parametric Techniques
- Statistical Testing
- Statistical Decision Theory

Learning Outcomes

Statistics: Probability and Descriptive Statistics

On successful completion, students will be able to

- define probability, random variable, and probability distribution.
- understand the concept of Bayesian statistics.
- grasp the definition of joint and marginal distributions.
- calculate expectation values and higher moments.
- comprehend important inequality equations and limit theorems.

Statistics - Inferential Statistics

On successful completion, students will be able to

- understand point estimation methods.
- apply maximum likelihood and ordinary least squares method to estimate parameters.
- comprehend the concept of statistical and systematic errors.
- employ error propagation methods.
- utilize Bayesian inference and non-parametric techniques.
- evaluate statistical tests.
- grasp the fundamentals of statistical decision theory.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Methods	All Bachelor Programmes in the Business & Management fields

Statistics: Probability and Descriptive Statistics

Course Code: DLBDSSPDS01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Statistical description and analysis are the foundations for data-driven analysis and prediction methods. This course introduces the fundamentals, beginning with a formal definition of probabilities and introduction to the concepts underlying Bayesian statistics.Random variables and probability density distributions are then discussed, as well as the concept of joint and marginal distributions. The importance of various discrete and continuous distributions and their applications is stressed.Characterizing distributions is an important aspect of describing the behavior of probability distributions. Students are familiarized with expectation values, variance, and covariance. The concepts of algebraic and central moments and moment-generating functions complement the characterization of probability distributions.Finally, this course focuses on important inequalities and limit theorems such as the law of large numbers or the central limit theorem.

Course Outcomes

On successful completion, students will be able to

- define probability, random variable, and probability distribution.
- understand the concept of Bayesian statistics.
- grasp the definition of joint and marginal distributions.
- calculate expectation values and higher moments.
- comprehend important inequality equations and limit theorems.

Contents

1. Probability
   - 1.1 Definitions
   - 1.2 Independent events
   - 1.3 Conditional probability
   - 1.4 Bayesian statistics
2. Random Variables
   - 2.1 Random Variables
   - 2.2 Distribution functions and probability mass functions
   - 2.3 Important discrete probability distributions
   - 2.4 Important continous probability distributions

3. Joint Distributions
   - 3.1 Joint distributions
   - 3.2 Marginal distributions
   - 3.3 Independent random variables
   - 3.4 Conditional distributions

4. Expectation and Variance
   - 4.1 Expectation of a random variable, conditional expectations
   - 4.2 Variance and covariance
   - 4.3 Expectations and variances of important probability distributions
   - 4.4 Algebraic and central moments
   - 4.5 Moment-generating functions

5. Inequalities and Limit Theorems
   - 5.1 Probability inequalities
   - 5.2 Inequalities for expectations
   - 5.3 The law of large numbers
   - 5.4 Central limit theorem

Literature

Compulsory Reading

Further Reading

- Downey, A.B. (2014). Think stats (2nd ed.). O'Reilly.
- Rohatgi, V. K., & Saleh, A. K. E. (2015). An introduction to probability and statistics. John Wiley & Sons, Incorporated.
- Triola , M.F. (2013). Elementary statistics. Pearson Education.
- Wagaman, A.S & Dobrow, R.P. (2021). Probability: With applications and R. Wiley.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Statistics - Inferential Statistics

Course Code: DLBDSSIS01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSSPDS01-01

Course Description

Statistical analysis and understanding are the foundations of data-driven methods and machine learning approaches.This course gives a thorough introduction to point estimators and discusses various techniques to estimate and optimize parameters. Special focus is given to a detailed discussion of both statistical and systematic uncertainties as well as propagation of uncertainties.Bayesian statistics is fundamental to data-driven approaches, and this course takes a close look at Bayesian techniques such as Bayesian parameter estimation and prior probability functions.Furthermore, this course gives an in-depth overview of statistical testing and decision theory, focusing on aspects such as A/B testing, hypothesis testing, p-values, and multiple testing which are fundamental to statistical analysis approaches in a broad range of practical applications.

Course Outcomes

On successful completion, students will be able to

- understand point estimation methods.
- apply maximum likelihood and ordinary least squares method to estimate parameters.
- comprehend the concept of statistical and systematic errors.
- employ error propagation methods.
- utilize Bayesian inference and non-parametric techniques.
- evaluate statistical tests.
- grasp the fundamentals of statistical decision theory.

Contents

1. Point Estimation
    - 1.1 Method of moments
    - 1.2 Sufficient statistics
    - 1.3 Maximum likelihood
    - 1.4 Ordinary least squares
    - 1.5 Resampling techniques
2. Uncertainties
    - 2.1 Statistical and systematic uncertainties
    - 2.2 Propagation of uncertainties

3. Bayesian Inference & Non-parametric Techniques
   - 3.1 Bayesian parameter estimation
   - 3.2 Prior probability functions
   - 3.3 Parzen windows
   - 3.4 K-nearest-neighbours

4. Statistical Testing
   - 4.1 A/B testing
   - 4.2 Hypothesis tests & test statistics
   - 4.3 P-values & confidence intervals
   - 4.4 Multiple testing

5. Statistical Decision Theory
   - 5.1 The risk function
   - 5.2 Maximum likelihood, Minimax, and Bayes
   - 5.3 Admissibility and Stein's paradox

Literature

Compulsory Reading

Further Reading

- Hogg, R. V., McKean, J., & Craig, A. T. (2020). Introduction to mathematical statistics, global edition. Pearson.
- Gutman, Alex J., Goldmeier, Jordan. (2021). Becoming a Data Head – How to Think, Speak, and Understand Data Science, Statistics, and Machine Learning. John Wiley & Sons.
- Borek Puza. (2015). Bayesian Methods for Statistical Analysis. ANU eView.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Slides	☑ Online Tests

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Slides	☑ Online Tests

Data Science and Object Oriented Programming with Python

Module Code: DLBSEWDSPP-01_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Ha Ngo (Introduction to Data Science) / Prof. Dr. Max Pumperla (Project: Object Oriented and Functional Programming in Python)

Contributing Courses to Module

- Introduction to Data Science (DLBDSIDS01-01)
- Project: Object Oriented and Functional Programming in Python (DLBDSOOFPP01)

Module Exam Type

Module Exam	Split Exam
	Introduction to Data Science • Study Format "Distance Learning": Advanced Workbook • Study Format "myStudies": Advanced Workbook Project: Object Oriented and Functional Programming in Python • Study Format "Distance Learning": Portfolio • Study Format "myStudies": Portfolio

Weight of Module
see curriculum

Module Contents

Introduction to Data Science

- Introduction to Data Science
- Data
- Data Science in Business
- Statistics
- Machine Learning

Project: Object Oriented and Functional Programming in Python

This course introduces the students to the advanced programming concepts of object orientation and functional programming and how they are realized in the Python programming language.

Learning Outcomes

Introduction to Data Science

On successful completion, students will be able to

- define data science and its relation to other fields.
- comprehend data science activities.
- recognize the origins of data and the challenges of working with data.
- understand how data science methods are integrated into business settings.
- grasp fundamental statistical concepts.
- appreciate the importance of machine learning in data science.

Project: Object Oriented and Functional Programming in Python

On successful completion, students will be able to

- explain basic notions in object-oriented programming such as functions and classes.
- understand object-oriented programming concepts and their relation to software design and engineering.
- describe advanced function concepts in Python.
- recognize important ideas from functional programming.
- recall important libraries for functional programming in Python.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Data Science & Artificial Intelligence	All Bachelor Programmes in the IT & Technology field

Introduction to Data Science

Course Code: DLBDSIDS01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Data science emerged as a multi-disciplinary field aimed at creating value from data. This course starts with an overview of data science and related fields and then defines data types and sources. Special focus is put on the assessment of data quality and electronic data processing.Use of data-driven methods has become vital for businesses, and this course outlines how data-driven approaches can be integrated within a business context and how operational decisions can be made using data-driven methods.Finally, this course highlights the importance of statistics and machine learning in the field of data science and gives an overview of relevant methods and approaches.

Course Outcomes

On successful completion, students will be able to

- define data science and its relation to other fields.
- comprehend data science activities.
- recognize the origins of data and the challenges of working with data.
- understand how data science methods are integrated into business settings.
- grasp fundamental statistical concepts.
- appreciate the importance of machine learning in data science.

Contents

1. Introduction to Data Science
   - 1.1 Definition of the term „data science“
   - 1.2 Data science and related fields
   - 1.3 Data science activities
2. Data
   - 2.1 Data types and data sources
   - 2.2 The 5Vs of data
   - 2.3 Data curation and data quality
   - 2.4 Data engineering
3. Data Science in Business
   - 3.1 Identification of use cases

3.2 Performance evaluation
3.3 Data-driven operational decisions
3.4 Cognitive biases

4. Statistics
   4.1 Importance of statistics for data science
   4.2 Important statistical concepts

5. Machine Learning
   5.1 Role of machine learning in data science
   5.2 Overview of machine learning approaches

Literature

Compulsory Reading

Further Reading

- Akerkar, R., & Sajja, P. S. (2016). Intelligent techniques for data science. Springer International Publishing.
- Hodeghatta, U. R., & Nayak, U. (2017). Business analytics using R—A practical approach. Apress Publishing.
- Runkler, T. A. (2012). Data analytics: Models and algorithms for intelligent data analysis. Springer.
- Skiena, S. S. (2017). The data science design manual. Springer International Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Online Tests
- ☑ Guideline

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Project: Object Oriented and Functional Programming in Python

Course Code: DLBDSOOFPP01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Students will build upon their foundational knowledge of Python programming, by exploring advanced Python programming concepts. To this end, important notions of object-oriented programming like classes and objects and pertaining design principles are outlined. Starting from an in-depth discussion of advanced features of Python functions, functional programming concepts and their implementation in Python are conveyed.

Course Outcomes

On successful completion, students will be able to

- explain basic notions in object-oriented programming such as functions and classes.
- understand object-oriented programming concepts and their relation to software design and engineering.
- describe advanced function concepts in Python.
- recognize important ideas from functional programming.
- recall important libraries for functional programming in Python.

Contents

- Students are being provided with a thorough introduction to important notions and concepts from the domain of object-oriented programming such as classes, objects, abstraction, encapsulation, inheritance, polymorphism, composition, and delegation. Additionally, the functional programming paradigm and pertaining ideas like functions as first class objects, decorators, pure functions, immutability and higher order functions are conveyed. Pursuant to the portfolio course type, the aforementioned concepts and ideas are explored by hands-on programming projects.

Literature
Compulsory Reading
Further Reading ▪ Lott, S. F. (2018). Functional Python programming: Discover the power of functional programming, generator functions, lazy evaluation, the built-in itertools library, and monads (2nd ed.). Packt Publishing. ▪ Lutz, M. (2013). Learning Python (5th ed.). O'Reilly. ▪ Phillips, D. (2018). Python 3 object-oriented programming: Build robust and maintainable software with object-oriented design patterns in Python 3.8 (3rd ed.). Packt Publishing. ▪ Ramalho, L. (2015). Fluent Python: Clear, concise, and effective programming. O'Reilly.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Internet of Things and Embedded Systems

Module Code: DLBSEWITES_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Marian Benner-Wickner (Introduction to the Internet of Things) / Jacko Nudzor (Embedded Systems)

Contributing Courses to Module

- Introduction to the Internet of Things (DLBINGEIT01_E)
- Embedded Systems (DLBROES01_E)

Module Exam Type

Module Exam	Split Exam
	Introduction to the Internet of Things • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes Embedded Systems • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Introduction to the Internet of Things

- Internet of Things Fundamentals
- Social and Economic Significance
- Communication Standards and Technologies
- Data Storage and Processing
- Design and Development
- Applicability

Embedded Systems

- Embedded Systems Architecture
- Embedded Hardware
- Embedded Software
- Distributed Systems and IoT Architecture
- Embedded Operating Systems

Learning Outcomes

Introduction to the Internet of Things

On successful completion, students will be able to

- grasp the distinctive features of Internet of Things (IoT) and IoT systems.
- understand the social and economic importance of Internet of Things.
- identify the most important standards for communication between IoT devices.
- differentiate between various techniques for storing and processing data in IoT systems.
- identify different architectures and technologies for structuring IoT systems.
- recognize challenges of data protection and data security in IoT systems.

Embedded Systems

On successful completion, students will be able to

- understand the architecture of embedded systems.
- understand real-time embedded systems.
- design the main architecture of embedded systems for robotics, automation and IoT infrastructure.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software and Engineering	All Bachelor Programmes in the IT & Technology fields

Introduction to the Internet of Things

Course Code: DLBINGEIT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of this course is to give students an insight into technical and theoretical basics of the Internet of Things (IoT) and its fields of application. In addition to the general structure of IoT systems and the technology standards used in them, students are also taught the importance of Internet of Things for economy and society. Furthermore, this course demonstrates how data is exchanged, stored and processed in IoT.

Course Outcomes

On successful completion, students will be able to

- grasp the distinctive features of Internet of Things (IoT) and IoT systems.
- understand the social and economic importance of Internet of Things.
- identify the most important standards for communication between IoT devices.
- differentiate between various techniques for storing and processing data in IoT systems.
- identify different architectures and technologies for structuring IoT systems.
- recognize challenges of data protection and data security in IoT systems.

Contents

1. Internet of Things Fundamentals
   - 1.1 The Internet of Things - Basics and Motivation
   - 1.2 Evolution of the Internet - Web 1.0 to Web 4.0
2. Social and Economic Significance
   - 2.1 Innovations for Consumers and Industry
   - 2.2 Implications on People and the World of Work
   - 2.3 Data Protection and Data Security
3. Communication Standards and Technologies
   - 3.1 Network Topologies
   - 3.2 Network Protocols
   - 3.3 Technologies
4. Data Storage and Processing

4.1 Networked Storage with Linked Data and RDF(S)
4.2 Analysis of Networked Data using a Semantic Reasoner
4.3 Processing of Data Streams with Complex Event Processing
4.4 Operation and Analysis of Large Data Clusters using NoSQL and MapReduce

5. Design and Development
5.1 Software Engineering for Distributed and Embedded Systems
5.2 Architectural Patterns and Styles for Distributed Systems
5.3 Platforms: Microcontrollers, Monoboard Computers, One-Chip Systems

6. Applicability
6.1 Smart Home / Smart Living
6.2 Ambient Assisted Living
6.3 Smart Energy / Smart Grid
6.4 Smart Factory
6.5 Smart Logistics

Literature

Compulsory Reading

Further Reading

- Buyya, R. & Vahid Dastjerdi, A. (Hrsg.) (2016). Internet of things. Principles and paradigms. Morgan Kaufmann, Cambridge (MA).
- Dian, F. J., & Vahidnia, R. (2020). IoT use cases and technologies. British Columbia Institute of Technology.
- Firouzi, F., Chakrabarty, K., & Nassif, S. (2020). Intelligent Internet of Things: From device to fog and cloud. Springer.
- Gilchrist, A. (2016). Industry 4.0. The industrial internet of things. Apress.
- Raj, P., & Raman, A. C. (2017). The Internet of things: enabling technologies, platforms, and use cases. CRC Press.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Embedded Systems

Course Code: DLBROES01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

To realize working engineering systems, embedded systems are required. Through embedding microprocessor-based systems capable of networking, data exchange and processing, the functionality of products and systems can be enhanced in terms of features, precision, accuracy, dynamic properties, intelligence. Actually, an embedded system is where everything begins. This course provides the basics on embedded system, by focusing on the architectural patterns of modern systems and platforms. The embedded hardware and software aspects are addressed. This course also introduces connectivity and networking aspects, which are required to build distributed systems for the internet of things and the industrial internet of things (finally yielding Cyber-Physical Systems).

Course Outcomes

On successful completion, students will be able to

- understand the architecture of embedded systems.
- understand real-time embedded systems.
- design the main architecture of embedded systems for robotics, automation and IoT infrastructure.

Contents

1. Introduction
   - 1.1 Embedded Systems Overview
   - 1.2 Hardware Elements of an Embedded System
   - 1.3 Standards, Compilers and Programming Languages
2. Elements of a Microcontroller
   - 2.1 Central Processing Units
   - 2.2 Volatile and non-volatile memory
   - 2.3 Digital/Analog Input/Output
   - 2.4 Timing peripherals
   - 2.5 Communication peripherals
3. Programming a Microcontroller

3.1 Bone Structure of a Microcontroller Software
3.2 Low-Level Programming
3.3 Usage of Middle-Level Libraries
3.4 Common IDEs and Tools

4. Embedded Operating Systems
   4.1 Task Management
   4.2 Scheduler
   4.3 Examples of Embedded Operating Systems

5. Distributed Systems and IoT Architecture
   5.1 Network Interfaces
   5.2 The Internet Protocol
   5.3 Examples of Distributed Systems

Literature

Compulsory Reading

Further Reading

- Noergaard, T. (2013). Embedded systems architecture: A comprehensive guide for engineers and programmers (2nd ed.). Newnes.
- White, E. (2011). Making embedded systems: Design patterns for great software. O'Reilly Media.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Robotics and Production Engineering

Module Code: DLBSEWRI-01_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Ha Ngo (Introduction to Robotics) / Prof. Dr. Hans Kerwat (Production Engineering Industry 4.0)

Contributing Courses to Module

- Introduction to Robotics (DLBROIR01-01_E)
- Production Engineering Industry 4.0 (DLBDSEAR01)

Module Exam Type

Module Exam	Split Exam
	Introduction to Robotics • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Production Engineering Industry 4.0 • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Introduction to Robotics

- Introduction to Robotics
- Trends
- Industrial Robots
- Mobile Robots
- Applications

Production Engineering Industry 4.0

- Introduction to Manufacturing Technology
- Main Production Groups According to DIN 8580
- Additive Manufacturing Processes
- Rapid Prototyping
- Rapid Tooling
- Direct/Rapid Manufacturing
- Cyber-Physical Production Plants

Learning Outcomes

Introduction to Robotics

On successful completion, students will be able to

- name important developments in the field of robotics.
- understand the mechanical structure and characteristics of robots.
- name characteristics and challenges of industrial robots.
- name characteristics and challenges of mobile robots.
- understand the role of robots in applications.
- name and understand current trends in the field of robotics.

Production Engineering Industry 4.0

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Engineering and Computer Science & Software Development	All Bachelor Programmes in the IT & Technology field

Introduction to Robotics

Course Code: DLBROIR01-01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Robotics is experiencing very interesting developments, which experts describe as being a transition to a new generation of robots. We have moved from the "4Ds" of Robotics 1.0 (dull, dirty, dumb, dangerous) to the "4Ss" of Robotics 2.0 (smarter, safer, sensors, simple), but we still need to proceed further to the "4Ms" of Robotics 3.0 (multitasking, emotive, morphing, multiagent). This course, thus, provides the required background to understand the main development of robotics looking at industrial as well as at mobile robots, their main characteristics, issues, challenges, applications, and development trends.

Course Outcomes

On successful completion, students will be able to

- name important developments in the field of robotics.
- understand the mechanical structure and characteristics of robots.
- name characteristics and challenges of industrial robots.
- name characteristics and challenges of mobile robots.
- understand the role of robots in applications.
- name and understand current trends in the field of robotics.

Contents

1. What is Robotics?
   - 1.1 Basics and Definitions
   - 1.2 History and Cultural Influence
   - 1.3 Challenges and Trends (from Robotics 1.0 to Robotics 3.0)
2. Robots
   - 2.1 Mechanical Structure
   - 2.2 Kinematic Chains
   - 2.3 Market Overview
3. Industrial Robots
   - 3.1 Components of Industrial Robot Systems
   - 3.2 Characteristics

3.3 Common Industrial Robots
3.4 Applications
3.5 Trends

4. Mobile Robots
4.1 Components of Mobile Robot Systems
4.2 Characteristics
4.3 Common Mobile Robots
4.4 Applications
4.5 Trends

5. Applications
5.1 Industrial Robots
5.2 Healthcare
5.3 Agriculture or Field Robotics
5.4 Space and Defense
5.5 Warehouse and Logistics
5.6 Construction
5.7 Wearables
5.8 Social Robots

Literature

Compulsory Reading

Further Reading

- Mihelj, M., Bajd, T., Ude, A., Lenarcic, J., Stanovnik, A., Munih, M., Rejc, J., & Slajpah, S. (2019). Robotics(2nd ed.). Springer.
- Ben-Ari, M., & Mondada, F. (2017). Elements of robotics. Springer.
- Siciliano, B., & Khatib, O. (Eds.). (2016). Springer handbook of robotics. Springer

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Practice Exam
- ☑ Online Tests

Production Engineering Industry 4.0

Course Code: DLBDSEAR01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of the course is to provide students with an overview of the processes that have influenced and still influence production processes through technological developments under the generic term Industry 4.0, based on traditional, standardized manufacturing techniques. These include, in particular, technological advances in additive manufacturing processes that enable applications such as rapid prototyping, rapid tooling, and direct manufacturing. Finally, the course deals with the consequences of the digitalization and networking of production facilities and their elements in the sense of a cyber-physical system.

Course Outcomes

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Contents

1. Introduction to Manufacturing Technology
    - 1.1 Basic Terms and Contexts in Manufacturing Theory
    - 1.2 Historical Development of Production
    - 1.3 The Discussion About the Long Tail
2. Classification Of Manufacturing Processes
    - 2.1 Casting and Molding
    - 2.2 Forming
    - 2.3 Machining
    - 2.4 Joining

2.5 Coating
2.6 Changing the Properties of Substances

3. Additive Manufacturing Processes
3.1 Basic Principles and Legal Aspects
3.2 Stereolithography (STL)
3.3 Selective Laser Sintering and Selective Beam Melting With Laser or Electron Beam
3.4 Fused Deposition Modeling (FDM)
3.5 Multi-Jet Modeling (MJM) and Poly-Jet Process (PJM)
3.6 3D Printing Process (3DP)
3.7 Laminating Processes
3.8 Mask Sintering

4. Rapid Prototyping
4.1 Definition
4.2 Strategic and Operational Aspects
4.3 Application Areas and Examples

5. Rapid Tooling
5.1 Definition, Strategic, and Operational Aspects
5.2 Indirect and Direct Procedures

6. Direct/Rapid Manufacturing
6.1 Potentials and Requirements for Procedures
6.2 Implementation, Application Areas, and Examples

7. Cyber-Physical Production Plants
7.1 Derivation of the Terms Industry 4.0 and Cyber-Physical Systems
7.2 Megatrend Cyber Physical Systems (CPS)
7.3 Definition Cyber-Physical Production Plant
7.4 Effects on Planning and Operation of Production Facilities
7.5 Dynamic Reconfiguration and Migration of Production Facilities

Literature
Compulsory Reading
Further Reading ▪ Anderson, C. (2012). Makers: The new industrial revolution. Crown Business. ▪ Gebhardt, A., Kessler, J. & Thurn, L. (2019). 3D printing: Understanding additive manufacturing (2nd ed). Hanser. ▪ Groover, M. P. (2012). Fundamentals of modern manufacturing: Materials, processes, and systems (5th ed.). Wiley.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Practice Exam
- ☑ Online Tests

International Management and Leadership

Module Code: DLBSEWIML_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Jonathan Black-Branch (International Management) / Simon Fischer (Leadership 4.0)

Contributing Courses to Module

- International Management (BWINT01)
- Leadership 4.0 (DLBWPLS01_E)

Module Exam Type

Module Exam	Split Exam
	International Management • Study Format "Duales myStudium": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes • Study Format "On Campus": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Leadership 4.0 • Study Format "Duales myStudium": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

International Management

- Globalization and the internationalization of business
- Assessment of political, legal, economic, and cultural Contexts
- Strategy in international business
- Organization in international business
- Marketing in international business
- Human resource management in international business

Leadership 4.0

- Conventional understanding of leadership
- Management tools
- Leadership versus management
- Integral concept of humankind as future-oriented model
- Characteristics and competencies of leaders
- Leadership models
- Agile Leadership instruments

Learning Outcomes

International Management

On successful completion, students will be able to

- recognize and explain the cultural, social, economic, historical, and political differences that affect strategic decision making on an international/global scale.
- gather specific information and conduct reliable assessments of the opportunities and risks related to business activities in different geographical market regions and specific national markets.
- describe the impact of culture on international business activities.
- identify different options for market entry and market development and participate in strategic planning activities that address these issues.
- design and evaluate different organizational structures for international businesses and design measures to optimize organizational structures for international operations.
- design, evaluate, and optimize human resource management practices for global and multinational companies.
- explain options for international marketing and select an appropriate marketing mix relative to specific products/services and the target market.
- identify and manage challenges associated with operating in an international/global business environment, such as the procurement and coordination of resources and human resource management.
- develop business plans that implement specific organizational, marketing, and distribution strategies in selected regions/countries.

Leadership 4.0

On successful completion, students will be able to

- understand the classical theories of leadership and new leadership models.
- distinguish between the terms leadership and management.
- reflect on the understanding of successful leadership models against the background of economic changes.
- develop an understanding of the need for alternative forms of organizational directing.
- implement appropriate leadership methods according to a company's level of complexity.
- draw upon a sound theoretical understanding that they can practice in applied research.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Business Administration & Management	All Bachelor Programs in the Business & Management field

International Management

Course Code: BWINT01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Globalization presents multiple opportunities and challenges to product and service industries. Many companies previously engaged in local markets must consider global trends and international markets, both on the demand and on the supply side. With this, comes new opportunities to market products and services. At the same time, complexity in daily business increases and managers have to face ambiguities and frequently changing contexts. With more competition, more diverse markets, and cultural, political, and legal challenges abroad, it has become more difficult to manage a company efficiently. All these factors call for managers to adopt a global mindset and sufficient cultural sensitivity.The course is designed to cover the economic, organizational, and cultural underpinnings that students need to grasp in order to better understand the managerial challenges that global organizations of all types and sizes have to cope with. Participants of this course will be provided with empirical knowledge and first-hand experiences of international management. Through multiple case studies within the course book, online lectures, and tutorials, students will develop a detailed understanding of the strategies and operational patterns necessary to successfully operate in international markets.

Course Outcomes

On successful completion, students will be able to

- recognize and explain the cultural, social, economic, historical, and political differences that affect strategic decision making on an international/global scale.
- gather specific information and conduct reliable assessments of the opportunities and risks related to business activities in different geographical market regions and specific national markets.
- describe the impact of culture on international business activities.
- identify different options for market entry and market development and participate in strategic planning activities that address these issues.
- design and evaluate different organizational structures for international businesses and design measures to optimize organizational structures for international operations.
- design, evaluate, and optimize human resource management practices for global and multinational companies.
- explain options for international marketing and select an appropriate marketing mix relative to specific products/services and the target market.
- identify and manage challenges associated with operating in an international/global business environment, such as the procurement and coordination of resources and human resource management.
- develop business plans that implement specific organizational, marketing, and distribution strategies in selected regions/countries.

Contents

1. Introduction to International Management
   - 1.1 What is Globalization?
   - 1.2 Facts about Globalization and the Global Economy
   - 1.3 Theoretical Explanations for Globalization
2. The International Company and its Environment
   - 2.1 International Companies and their Operations
   - 2.2 Operational Patterns in International Markets
   - 2.3 Assessment of the Environment for Internalization
3. Culture and International Business
   - 3.1 A Generic Perspective on Culture
   - 3.2 Organizational Culture
   - 3.3 Cultural Diversity and the Contemporary Manager
4. Strategy Development in International Business
   - 4.1 Strategy in Globalized Business Operations
   - 4.2 Strategy Concepts and Strategic Options

4.3 Managing Strategy

5. International Human Resource Management
   - 5.1 Characteristics of International Human Resource Management
   - 5.2 The Global Manager
   - 5.3 Instruments in International Human Resource Management

6. Organization in International Business
   - 6.1 Traditional Perspectives on Business Organization
   - 6.2 Modern Views on Business Organization
   - 6.3 Coordination of Intra-Organization Collaboration

7. International Marketing
   - 7.1 Marketing in International Business
   - 7.2 Strategic Choices in International Marketing
   - 7.3 Marketing Mix Choices in International Marketing

Literature

Compulsory Reading

Further Reading

- Deresky, H. (2016). International management (9th ed.). Harlow: Prentice Hall International
- Collinson, C., Narula, R., and Rugma, Alan.M. (2020). International Business, 8th edition Pearson.
- Peng, M. W., & Meyer, K. (2023). International business. (4th ed.) London: Cengage Learning Emea.
- Daniels, J. D., Radebaugh, L. H., & Sullivan, D. P. (2019). International business: Environments and Operations (16th ed.). Harlow: Pearson.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format On Campus

Study Format	Course Type
On Campus	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Leadership 4.0

Course Code: DLBWPLS01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Today, competitiveness depends more than ever on continuous innovation. This puts new demands on the management of companies. The task of successful leaders in innovation and business is no longer to offer direction and solutions, but to create a framework in which others develop innovations. This change, which is currently taking place with full force in companies, requires further developments on classic leadership concepts and its principles.Against the background of digital change and the advance of artificial intelligence, established business models are constantly being put to the test. On the one hand, it is important to work on several projects simultaneously and to adapt flexibly to changing conditions at any time; on the other hand, employees want to be integrated into the work process in a different way. Consideration and flexibility for their personal and family situation play an increasing role. Innovation and business leaders can only meet all these diverse challenges with Leadership by inspiring others to think ahead and act inter-divisionally, in other words, to be visionary. This course tries to convey knowledge, understanding and tools for this challenging field of work.

Course Outcomes

On successful completion, students will be able to

- understand the classical theories of leadership and new leadership models.
- distinguish between the terms leadership and management.
- reflect on the understanding of successful leadership models against the background of economic changes.
- develop an understanding of the need for alternative forms of organizational directing.
- implement appropriate leadership methods according to a company's level of complexity.
- draw upon a sound theoretical understanding that they can practice in applied research.

Contents

1. Basics of the Leadership Concept
    - 1.1 Definition of the Leadership Concept and Leadership Actions
    - 1.2 Development of the Understanding of Leadership
    - 1.3 The Role of Communication in Leadership
    - 1.4 New Challenges for Leadership
2. Leadership Versus Management

2.1 Distinctions between these Concepts
2.2 Relevance of Leadership in the Context of Technological Change
2.3 New Forms of Work as a Challenge for Leadership 4.0

3. Organizational Prerequisites for Successful Leadership
3.1 Launching Corporate Governance Initiatives
3.2 From Process to Project Management
3.3 Managing Limited Resources

4. Personal Factors for Successful Leadership
4.1 Personal Characteristics
4.2 Technological Know-how
4.3 Policy and Compliance

5. Management Tools
5.1 Definition, Differentiation and Challenges
5.2 Use of Direct Management Tools
5.3 Use of Indirect Management Tools

6. Leadership 4.0 Models
6.1 Transformational Leadership
6.2 Leadership as an Agile Role
6.3 Authentic Leadership

7. Leadership 4.0 Case Studies
7.1 Allsafe Jungfalk
7.2 Automattic

Literature

Compulsory Reading

Further Reading

- Seliger, R (2022): Positive Leadership. The Management revolution, Schäffer-Poeschel, Freiburg
- Luthans, F. (2021): Organizational Behavior: An Evidence-Based Approach, 14th Edition. Charlotte, NC : Information Age Publishing.
- Helmod, M. (2021): New Work, Transformational and Virtual Leadership: Lessons from Covid-19 and other crisis, Springer, Wiesbaden.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

International Marketing and Branding

Module Code: DLBDSEIMB

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Josephine Zhou-Brock (International Marketing) / Prof. Dr. Josephine Zhou-Brock (International Brand Management)

Contributing Courses to Module

- International Marketing (DLBDSEIMB01)
- International Brand Management (DLBDSEIMB02)

Module Exam Type

Module Exam	Split Exam
	International Marketing • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "Duales myStudium": Exam, 90 Minutes International Brand Management • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

International Marketing

- International marketing strategy
- Cultural differences and their significance for marketing
- International marketing mix (product, price, promotion, and distribution decisions in an international environment)
- International market research and consumer behavior
- Ethical aspects in international marketing
- International marketing controlling and six sigma

International Brand Management

- Basics of brand management
- Framework conditions for brands in international markets
- Strategies and concepts of international brands
- Brand architectures and brand extension options
- Brand management and communication
- Brand management according to the stakeholder concept
- Brand control and protection

Learning Outcomes

International Marketing

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

International Brand Management

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

International Marketing

Course Code: DLBDSEIMB01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Students are taught the necessity for strategic marketing in an international context. They will learn about essential cultural differences and their influences on international marketing management. The basic decisions, standardizations, and adaptations in international marketing are experienced by the students on the basis of different concepts in the international marketing mix. The necessity of international market research, strategic planning, and control are taught to the students, along with the ethical aspects in international marketing. The students analyze current topics in international marketing management and reflect on them in connection with the concepts they have learned in this course.

Course Outcomes

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

Contents

1. Strategic International Marketing
   - 1.1 Internationalization
   - 1.2 Theoretical Foundations of International Market Entry Strategies
   - 1.3 Forms of International Market Entry
2. Cultural Differences as an Aspect of International Marketing
   - 2.1 Overview of Culture
   - 2.2 Cultural Model Based on Hofstede
   - 2.3 Cultural Model Based on Trompenaars
3. Case Studies in International Market Entry and Marketing Strategies
   - 3.1 Case Study: Nivea in South Korea

3.2 Case Study: Bosch and Siemens Hausgeräte GmbH in China
3.3 Case Study: Siemens Mobile in China
3.4 Case Study: Siemens in China

4. International Product Management and Product Development
4.1 Goals of International Product Management
4.2 Framework Conditions for International Product Management
4.3 International Product Decisions
4.4 International Product Development

5. Exchange Rate Fluctuations and International Price Calculation
5.1 Tasks and Objectives of International Price Management
5.2 Factors Influencing International Price Management
5.3 Instruments of International Price Management

6. International Communication and International Sales Policy
6.1 International Communication Management
6.2 International Sales Management

7. International Marketing and Ethics
7.1 Overview of International Marketing and Ethics
7.2 Business Ethics in International Companies
7.3 Case Study: Nestlé

8. Applied Market Research and Its Influence on Consumer Behavior
8.1 Scope of International Market Research
8.2 Requirements for International Market Research Information
8.3 International Secondary Research
8.4 International Primary Research

9. Monitoring and Control in International Marketing
9.1 Controlling in International Management

10. Six Sigma, Brand Management, and Rebranding
10.1 Six Sigma: Basics, Definitions, and Processes
10.2 Brand Management
10.3 Rebranding

Literature
Compulsory Reading
Further Reading ▪ Armstrong, G., Kotler, P., & Opresnik, M. O. (2019). Marketing: An introduction (14th ed.). Pearson. ▪ Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). Cultures and organizations—Software of the mind: Intercultural cooperation and its importance for survival. McGraw-Hill. ▪ Hollensen, S. (2020). Global marketing (8th ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

International Brand Management

Course Code: DLBDSEIMB02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of this course is to deepen and expand the knowledge acquired in the introductory elective course International Marketing. The value of a brand is a decisive competitive advantage for companies in international business. Brands create long-term and profitable customer relationships. Brands are therefore valuable assets for companies and organizations. Students learn the basics of brand management before moving on to the concepts and success factors of international brand management. Students also become familiar with the structure of brand architectures and the possibilities of brand extensions. The fact that different stakeholder groups must be taken into account in brand management is communicated to the students on the basis of the stakeholder concept. In addition, the students get to know the various methods for measuring brand value and brand controlling. The aspects of trademark protection that are particularly important in an international environment will be dealt with conclusively.

Course Outcomes

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Contents

1. Basics of Brand Management
    - 1.1 Brand Significance and Brand Understanding
    - 1.2 Market Conditions
    - 1.3 Tasks and Goals of Brand Management
2. Brand Identity, Brand Positioning, and Brand Personality
    - 2.1 Brand Identity as the Basis of Brand Management

2.2 Brand Positioning
2.3 Brand Image
2.4 Brand Personality

3. Brand Strategies
3.1 The Challenges for Brand Strategies
3.2 Brand Strategies for New Products
3.3 Trademark Licensing

4. International Branding
4.1 Importance of Branding for International Companies
4.2 Brand Concepts for International Brands
4.3 Factors for Successful International Brands

5. Brand Architectures and Types of Branding
5.1 Brand Hierarchies
5.2 Co-branding and Ingredient Branding

6. Brand Management and Communication
6.1 Classic Brand Communication
6.2 Brand Communication on the Internet

7. Brand Expansion
7.1 Basics of Brand Extension
7.2 Opportunities and Risks of Brand Extension
7.3 Ideal Typical Sequence of the Brand Extension Process

8. Brand Management According to the Stakeholder Concept
8.1 Basics of Brand Management According to the Stakeholder Principle
8.2 Stakeholder Groups: Consumer Stakeholder Groups
8.3 Stakeholder Groups: Shareholders and Financial Investors
8.4 Stakeholder Groups: Employees
8.5 Stakeholder Groups: Suppliers and the Public

9. Brand Control
9.1 Basics of Brand Controlling
9.2 Importance and Measurement of Brand Value
9.3 Practical Methods for Measuring Brand Value

10. Trademark Protection
    - 10.1 Object of Trademark Protection
    - 10.2 Origin of Trademark Protection
    - 10.3 Trademark Infringements

Literature

Compulsory Reading

Further Reading

- Beverland, M. (2021). Brand management: Co-creating meaningful brands (2nd ed.). SagePublications Ltd.
- Burmann, C., Riley, N. M., Halaszovich, T., & Schade, M. (2017). Identity-based brand management:Fundamentals—strategy—implementation—controlling. Springer Gabler.
- Kapferer, J. N. (2012). The new strategic brand management: Advanced insights and strategicthinking (5th ed.). Kogan Page.
- Keller, K. L., & Swaminathan, V. (2019). Strategic brand management: Building, measuring, andmanaging brand equity (5th ed., Global ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Applied Sales

Module Code: DLBDSEAS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Tanja Moehler (Applied Sales I) / Tanja Moehler (Applied Sales II)

Contributing Courses to Module

- Applied Sales I (DLBDSEAS01)
- Applied Sales II (DLBDSEAS02)

Module Exam Type

Module Exam	Split Exam
	Applied Sales I • Study Format "Distance Learning": Exam, 90 Minutes Applied Sales II • Study Format "Distance Learning": Exam or Advanced Workbook, 90 Minutes

Weight of Module

see curriculum

Module Contents

Applied Sales I

- Fundamentals of Applied Sales
- The Distribution System
- Personal Sales
- Sales Plans
- New Customer Acquisition
- A Sales Visit
- Conversational Tactics
- Conducting Negotiations
- Other Sales Channels

Applied Sales II

- Marketing and Sales
- Customer Satisfaction as a Success Factor
- Personalities in Sales
- Customer-Oriented Communication
- Presentation and Rhetoric
- Customer Loyalty
- Networking
- Case Study

Learning Outcomes

Applied Sales I

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Applied Sales II

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

Applied Sales I

Course Code: DLBDSEAS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The demands on sales thinking are growing every day. Globalized demand combined with high competition is making it increasingly difficult for companies to compete for customers. At the same time, customers are becoming better informed, while traditional supply markets are saturated and at overcapacity. In order to be successful in such an environment, sales thinking and action are required along with a new type of salesperson. Within the course Applied Sales I (Introduction), the participants are familiarized with the basic concepts of applied sales. You will learn about sales organization, dealing with alternative sales channels, and get to know the dedicated sales planning process. The contents of the module are complemented by the successful acquisition of new customers, whereby particular attention is paid to the organization and implementation of customer visits and the conduct of discussions and negotiations.

Course Outcomes

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Contents

1. Fundamentals of Applied Sales and Distribution
   - 1.1 Tasks and Forms of Applied Distribution
   - 1.2 Marketing as the Basis of Sales
   - 1.3 Distribution, Sales, and Other Terms
   - 1.4 Sales in Different Economic Sectors
2. The Distribution System

2.1 Forms of Sales
2.2 Sales Organisation
2.3 Key Account Management
2.4 Multi-Channel Distribution

3. Personal Sales
3.1 The "New Sellers"
3.2 Requirements for Sales Personalities
3.3 The Key Account Manager
3.4 Task of Sales Managers

4. Sales Plan
4.1 Tasks and Objectives of Sales Management
4.2 Observation of Competition in the Context of Sales Management
4.3 Potential Analyses and Sales Planning
4.4 Sales Control and Visit Strategies

5. New Customer Acquisition
5.1 Identification of New Customer Potential
5.2 Customer Relationship Management and Customer Acquisition
5.3 Trade Fairs and Events
5.4 Networking

6. The Sales Visit
6.1 Frequency and Preparation of Visits
6.2 Conduct of a Visit
6.3 Visit Reports and Follow-Up
6.4 Aftercare and Follow-Up

7. Conversational Tactics
7.1 Structured Conversation Preparation
7.2 Goal-Oriented Conversation: The D.A.L.A.S Model
7.3 Questioning Techniques

8. Conducting Negotiations
8.1 Psychology of Negotiation
8.2 Negotiation Structure
8.3 Objection Handling
8.4 Price Negotiations

9. Other Sales Channels
   - 9.1 Telemarketing
   - 9.2 Catalogue and Brochure Sales
   - 9.3 Internet and E-Commerce

Literature

Compulsory Reading

Further Reading

- Bloomfield, J. (2020). NeuroSelling: Mastering the customer conversation using the surprising science of decision making. Axon Publishing.
- Jobber, D., Lancaster, G., & Le Meunier-FitzHugh, K. (2019). Selling and sales management (10th ed.). Pearson.
- Peppers, D., & Rogers, M. (2016). Managing customer experience and relationships: A strategic framework (3rd ed.). Wiley.
- Pink, D. H. (2012). To sell is human: The surprising truth about moving others. Riverhead Books.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Applied Sales II

Course Code: DLBDSEAS02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The course Applied Sales II builds on the basics taught in the course "Applied Sales I" and broadens and deepens them. First, the tension between marketing and sales is examined in more detail. Based on this, essential backgrounds and central target figures for successful sales management (e.g., customer satisfaction and loyalty as well as the customer life cycle) are derived and operationalized in order to create the basis for efficient and effective customer relationship management. As the process progresses, attention will also be paid to mental processes and consumer behavior in general. In addition, strategies and paths to successful negotiation are deepened and supplemented by convincing communication techniques. The course concludes with a case study in the course of which the students have the opportunity to apply what they have learned in a practice-oriented manner.

Course Outcomes

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Contents

1. Marketing and Sales
    - 1.1 Marketing and Business Philosophy
    - 1.2 Sales Marketing in Different Economic Sectors
    - 1.3 Relationship Marketing

1.4 (International) Marketing and Sales Integration

2. Customer Satisfaction as a Success Factor
   - 2.1 Customer Relationship Management (CRM)
   - 2.2 Customer Orientation Success Chain
   - 2.3 Customer Relationship Strategies

3. Customer Retention
   - 3.1 Customer Retention Management
   - 3.2 Customer Retention Tools
   - 3.3 Complaints Management

4. Customer-Oriented Communications
   - 4.1 Communication and Sales Promotion by Sales Staff
   - 4.2 Sales Promotion by Sales Team
   - 4.3 Sales Promotion by the Company

5. Personalities in Sales
   - 5.1 Sales Personalities
   - 5.2 Selling in Teams
   - 5.3 Negotiating with Committees

6. Presentation and Rhetoric
   - 6.1 Rhetoric in Sales
   - 6.2 Presentation Techniques
   - 6.3 Nonverbal Communication

7. Networking
   - 7.1 Organizational Networks and Networking
   - 7.2 Building and Shaping Relationships
   - 7.3 Networking via Social Media

8. Case Study—Multi-Vendor Customer Loyalty Programs
   - 8.1 German Consumer Goods Market & Drugstore Industry Situation
   - 8.2 PAYBACK—A German Synonym for Loyalty Cards

Literature
Compulsory Reading
Further Reading ▪ Homburg, C., Schäfer, H., & Schneider, J. (2012). Sales excellence: Systematic sales management. Springer Science & Business Media. ▪ Ingram, T. N., Schwepker, C. H., Williams, M. R., Avila, R. A., & LaForge, R. W. (2020). Salesmanagement: Analysis and decision making (10th ed.). Routledge, Taylor & Francis Group. ▪ Kotler, P., & Keller, K. L. (2021). Marketing management (16th, global ed.). Pearson Education.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Supply Chain Management

Module Code: DLBDSESCM

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Alex Leberling (Supply Chain Management I) / N.N. (Supply Chain Management II)

Contributing Courses to Module

- Supply Chain Management I (DLBDSESCM01)
- Supply Chain Management II (DLBDSESCM02)

Module Exam Type

Module Exam	Split Exam
	Supply Chain Management I • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Supply Chain Management II • Study Format "myStudies": Exam or Advanced Workbook, 90 Minutes • Study Format "Distance Learning": Exam or Advanced Workbook, 90 Minutes

Weight of Module

see curriculum

Module Contents

Supply Chain Management I

- Historical and terminological aspects of the SCM concept
- Motives for the creation of cross-company value creation networks
- Design principles and effects of value creation networks
- Logistical core processes and SCM
- Information technology aspects of the SCM concept
- Coordination and collaboration of the network partners
- Industry-specific solutions of the SCM

Supply Chain Management II

- Strategic aspects of SCM
- SCM Practice: Tasks and Activities in the Core Planning Process
- SCM Practice: Tasks and Activities in the Core Process of Procurement
- SCM Practice: Tasks and Activities in the Core Process Production
- SCM Practice: Tasks and Activities in the Core Distribution Process

Learning Outcomes

Supply Chain Management I

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Supply Chain Management II

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fields of Logistics & Transportation	All Bachelor Programmes in the Transport & Logistics fields

Supply Chain Management I

Course Code: DLBDSESCM01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

SCM proves to be an extremely multi-faceted construct from both a theoretical and a practical point of view. An adequate understanding of the problem dimensions and modes of action of (global) cross-company value creation networks requires a multidimensional approach. It starts by considering logistical processes, with modern process, flow, and network standards forming an important basis for SCM. On the basis of such an approach, students should gain a fundamental understanding of SCM. From the point of view of a holistic approach, it also makes sense to also examine a number of other typical problem areas in addition to the logistical challenges of this concept. This includes IT aspects of SCM (e.g., APS systems), and questions to do with the collaboration and coordination of network partners. This course also considers selected industry specific SCM solutions (ECR or VMI).

Course Outcomes

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Contents

1. Fundamentals of the Supply Chain Concept
    - 1.1 Terminological and Conceptual Fundamentals
    - 1.2 Supply Chain Typology According to Otto
    - 1.3 Supply Chain Typology According to Bechtel/Jayaram
    - 1.4 Dynamic Aspects of Supply Chains

2. Selected Theoretical Concepts for the Supply Chain Concept
   - 2.1 New Institutional Economics
   - 2.2 Game Theory
   - 2.3 Network Approach
   - 2.4 Other Theoretical Additions

3. Supply Chain Management
   - 3.1 Basic Information on the Goals and Scope of SCM
   - 3.2 Popular Problem Areas of the SCM
   - 3.3 Supply Chain Management as an Evolutionary Step in Logistics
   - 3.4 Supply Chain Management as Cooperation Management

4. SCM Model
   - 4.1 Basic Information on the Term SCM Models
   - 4.2 SCOR Model
   - 4.3 SCM Task Model

5. SCM as a Coordination Problem
   - 5.1 Basic Information on the Concept of Coordination
   - 5.2 Coordination Concepts, Context, and Perspectives of SCM
   - 5.3 Coordination Instruments

Literature

Compulsory Reading

Further Reading

- Bowersox, J., Closs, D., & Cooper, M. B. (2020). Supply chain logistics management (5th ed.). McGraw Hill Education.
- Chopra, S., & Meindl, P. (2019). Supply chain management: Strategy, planning, and operation (7th ed., Global ed.). Pearson Education.
- Es-Satty, Asmaa; Lemghari, Radouane; Okar, Chafik. (2020). Supply Chain Digitalization Overview SCOR model implication. In: 2020 IEEE 13th International Colloquium of Logistics and Supply Chain Management (LOGISTIQUA) Logistics and Supply Chain Management (LOGISTIQUA), 2020 IEEE 13th International Colloquium of. :1-7 Dec, 2020; IEEE Language: English, Datenbank: IEEE Xplore Digital Library.
- Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of enhanced enterprise resource planning (ERP) on firm performance through green supply chain management. Sustainability, 13(8), article 4358.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Supply Chain Management II

Course Code: DLBDSESCM02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

From the perspective of strategic management research and practice, the activities covered by the term SCM are closely related to efforts to build and/or maintain a stable operational competitive advantage. A fundamental discussion of this relationship forms the starting point for the course. On this basis, a differentiated analysis of strategy-relevant activities and instruments in the Plan, Source, Make, Deliver, and Return process categories is then carried out using the SCOR model. Special attention is given to the practice-relevant areas of SCM, e.g., order-promising (plan), supplier-relation-management (source), postponement (make), and the ECR-concept (deliver).

Course Outcomes

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Contents

1. Strategic Aspects of SCM
   - 1.1 Strategic Thinking and Action: General Information
   - 1.2 Competition Focus and SCM
   - 1.3 Competition Location and SCM
   - 1.4 Competition Rules and SCM

2. SCM Practice: Core Process Planning
   - 2.1 General Preliminary Considerations
   - 2.2 Collaborative Planning, Forecasting, and Replenishment
   - 2.3 Order Promoting

2.4 Kanban
2.5 Integration of X-PL Logistics Service Providers

3. SCM Practice: Core Process Procurement
   3.1 General Preliminary Considerations
   3.2 Production Synchronous Procurement
   3.3 Sourcing Concepts
   3.4 Supplier Relations Management

4. SCM Practice: Core Process Production
   4.1 Selected Aspects of the Problem Background
   4.2 Collaborative Engineering
   4.3 Postponement Strategies
   4.4 Value Added Partnership

5. SCM Practice: Core Process Distribution
   5.1 Basic Information on the Distribution Problem
   5.2 Efficient Consumer Response (ECR)
   5.3 Consignment Warehouse

Literature

Compulsory Reading

Further Reading

- Chopra, S. (2019). Supply chain management: Strategy, planning and operation (Global ed., 7th ed.). Pearson.
- Hill, A., & Hill, T. (2018). Essential operations management (2nd ed.). Palgrave.
- Hugos, M. (2011). Essentials of supply chain management (3rd ed.). John Wiley & Sons.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

6. Semester

Mathematics Basics

Module Code: DLBSEWMG_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Veronica Mas (Mathematics I) / Dr. Annika Denkert (Mathematics II)

Contributing Courses to Module

- Mathematics I (DLBCSM101)
- Mathematics II (DLBCSM201)

Module Exam Type

Module Exam	Split Exam
	Mathematics I • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes Mathematics II • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Mathematics I

- Basic Definitions and Terms of Discrete Mathematics
- Sets and Propositional Logic
- Number Systems such as Decimal and Binary Systems
- Graphs and Mappings
- Selected Topics of Elementary Number Theory
- Cryptography

Mathematics II

- Selected Topics of Linear Algebra
- Selected Chapters on Graphs and Algorithms

Learning Outcomes

Mathematics I

On successful completion, students will be able to

- understand basic terms of discrete mathematics as well as describe them and distinguish them from each other.
- understand concepts of number theory and their application in IT and technology and be able to solve tasks independently by applying these concepts.

Mathematics II

On successful completion, students will be able to

- understand basic concepts of linear algebra, their interrelations, and their application in IT and technology and be able solve tasks independently using these concepts.
- understand and distinguish the basic concepts and important algorithms for graphs and trees from the field of discrete mathematics as well as their application in IT and technology.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Methods.	All Bachelor Programmes in the Business & Management field.

Mathematics I

Course Code: DLBCSM101

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Many practical concepts in IT and technology are based on the findings of discrete mathematics. For an in-depth understanding of, for example, data structures, the construction of communication networks, or of solutions to algorithmic problems, a basic understanding of their mathematical background is necessary. This course therefore introduces discrete mathematical terms and concepts, with specific areas of number theory also taught.

Course Outcomes

On successful completion, students will be able to

- understand basic terms of discrete mathematics as well as describe them and distinguish them from each other.
- understand concepts of number theory and their application in IT and technology and be able to solve tasks independently by applying these concepts.

Contents

1. Mathematical Basics
   - 1.1 Basic Concepts
   - 1.2 Proof Techniques
   - 1.3 Finite Sums
2. Sets
   - 2.1 Properties and Calculation Rules for Sets
   - 2.2 Equivalence Relations
3. Propositional Logic
   - 3.1 Statements and Logical Connections
   - 3.2 Truth Tables
   - 3.3 Computational Rules of Propositional Logic
   - 3.4 Simplification of Expressions in Propositional Logic
4. Number Systems
   - 4.1 Decimal System

4.2 Binary System
4.3 Hexadecimal System

5. Mappings
   5.1 Mappings and Graphs
   5.2 Special Properties of Mappings

6. Basic Algebraic Structures
   6.1 Groups
   6.2 Rings
   6.3 Residual Class Rings

7. Prime Numbers
   7.1 Definition and Properties of Prime Numbers
   7.2 Prime Number Test

8. Modular Arithmetic
   8.1 The Euclidean Algorithm
   8.2 Fundamental Theorem of Arithmetic

9. Applications in Cryptography
   9.1 The Shift Cryptosystem
   9.2 Symmetric vs Asymmetric Cryptosystems
   9.3 The RSA Cryptosystem

Literature
Compulsory Reading
Further Reading
▪ Rosenthal, D., Rosenthal, D., Rosenthal, P. (2018). A Readable Introduction to Real Mathematics (2nd ed.). Springer.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Mathematics II

Course Code: DLBCSM201

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course continues the introduction to topics of discrete mathematics which began in the module "Mathematics Fundamentals I". In this course, the concepts of linear algebra are introduced and knowledge about graphs and algorithms for graphs is deepened. Typical questions of applied computer science are selected, and students are shown how they can be solved with graphs.

Course Outcomes

On successful completion, students will be able to

- understand basic concepts of linear algebra, their interrelations, and their application in IT and technology and be able solve tasks independently using these concepts.
- understand and distinguish the basic concepts and important algorithms for graphs and trees from the field of discrete mathematics as well as their application in IT and technology.

Contents

1. Introduction to Matrices
   - 1.1 Basic Concepts of Matrices
   - 1.2 Addition of Matrices
   - 1.3 Scalar Multiplication and Product
2. Inverting Matrices
   - 2.1 Multiplication of Matrices
   - 2.2 Properties of Matrix Multiplication
   - 2.3 Inverse Matrices
3. Linear Systems of Equations
   - 3.1 Gauss Algorithm
   - 3.2 Example Applications of the Gaussian Algorithm
4. Introduction to Graphs
   - 4.1 Undirected Graphs
   - 4.2 Further Properties of Graphs

4.3 Adjacency Matrix

5. The Problem of the Shortest Routes
   - 5.1 Directional Graph or Digraph
   - 5.2 Weighted Graph
   - 5.3 Dijkstra's Algorithm

6. The Königsberg Bridge Problem
   - 6.1 Routing in Graphs
   - 6.2 Eulerian Graph
   - 6.3 Hierholzer's Algorithm
   - 6.4 The Postman Problem

7. A City Tour Where Each City is Visited Exactly Once.
   - 7.1 Special Graphs
   - 7.2 Hamiltonian Graph
   - 7.3 The Ore and Dirac Condition
   - 7.4 The Problem of the Traveling Salesman

8. Trees
   - 8.1 Properties of Trees
   - 8.2 Root Tree
   - 8.3 Spanning Tree
   - 8.4 Minimal Spanning Tree

Literature

Compulsory Reading

Further Reading

- Benjamin, A., Chartrand, G., and Zhang, P. (2017). The fascinating world of graph theory. Princeton University Press.
- Erciyes, J. (2021). Discrete mathematics and graph theory: A concise study companion and guide. Princeton University Press.
- Lewis, H., & Zax, R. (2019). Essential discrete mathematics for computer science. Princeton University Press.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Mathematics: Linear Algebra and Analysis

Module Code: DLBSEWMLAA_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Robert Graf (Mathematics: Linear Algebra) / Prof. Dr. Robert Graf (Mathematics: Analysis)

Contributing Courses to Module

- Mathematics: Linear Algebra (DLBDSMFLA01)
- Mathematics: Analysis (DLBDSMFC01)

Module Exam Type

Module Exam	Split Exam
	Mathematics: Linear Algebra • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Mathematics: Analysis • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Mathematics: Linear Algebra

- Matrix Algebra
- Vector Spaces
- Linear and Affine Transformations
- Analytical Geometry
- Matrix Decomposition

Mathematics: Analysis

- Sequences and Series
- Functions and Reverse Functions
- Differential Calculus
- Integral Calculus

Learning Outcomes

Mathematics: Linear Algebra

On successful completion, students will be able to

- explain fundamental notions in the domain of linear equation systems.
- exemplify properties of vectors and vector spaces.
- summarize characteristics of linear and affine mappings.
- identify important relations in analytical geometry.
- utilize different methods for matrix decomposition.

Mathematics: Analysis

On successful completion, students will be able to

- summarize the basic concepts of analysis.
- illustrate the terms "sequences" and "series".
- explain the concept of a function and determine the inverse function where possible.
- compute derivatives and integrals using the standard rules of differentiation and integration.
- explain the relationship between differentiation and integration.
- solve simple linear differential equations.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Methods.	All Bachelor Programmes in the Business & Management field.

Mathematics: Linear Algebra

Course Code: DLBDSMFLA01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Linear algebra is a fundamental subject in mathematics. Its historical origin lies in the development of solution techniques for systems of linear equations arising from geometric problems. Numerous scientific and engineering applications can be solved using its methods. This course introduces the foundations of linear algebra and its basic notions like vectors and matrices. It then builds upon this foundation by introducing the derivation of solution techniques for problems in analytical geometry.

Course Outcomes

On successful completion, students will be able to

- explain fundamental notions in the domain of linear equation systems.
- exemplify properties of vectors and vector spaces.
- summarize characteristics of linear and affine mappings.
- identify important relations in analytical geometry.
- utilize different methods for matrix decomposition.

Contents

1. Foundations
   - 1.1 Systems of Linear Equations
   - 1.2 Matrices: Basic Terms
   - 1.3 Matrix algebra
   - 1.4 Matrices as compact representations of linear equations
   - 1.5 Inverse and trace
2. Vector Spaces
   - 2.1 Definition
   - 2.2 Linear Combination and Linear Dependance
   - 2.3 Basis, Linear Envelope, and Rank
3. Linear and Affine Mapping
   - 3.1 Matrix Representation of Linear Mappings
   - 3.2 Image and Kernel

3.3 Affine Spaces and Subspaces
3.4 Affine Mapping

4. Analytical Geometry
   4.1 Norm
   4.2 Scalar Product
   4.3 Orthogonal Projections
   4.4 Outlook: Complex Numbers

5. Matrix Decomposition
   5.1 Determinant
   5.2 Eigenvalues and Eigenvectors
   5.3 Cholesky Decomposition
   5.4 Eigenvalue Decomposition and Diagonalisation
   5.5 Singular Value Decomposition

Literature

Compulsory Reading

Further Reading

- Aggarwal, C.C. (2020). Linear Algebra and Optimization for Machine Learning: A Textbook. Springer.
- Mathai, A. M., & Haubold, H. J. (2017). Linear algebra, a course for physicists and engineers (1st ed.) De Gruyter.
- Neri, F. (2019). Linear algebra for computational sciences and engineering (2nd ed.) Springer.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Audio	☑ Online Tests
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Mathematics: Analysis

Course Code: DLBDSMFC01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Analysis is one of the essential basic subjects of mathematics. Originally developed to be able to formulate and solve problems of classical mechanics mathematically, in its present rigorous form it has become indispensable in numerous applications in the natural sciences and technology. This module aims to introduce the basic tool of differential and integral calculus and to explain their mutual interrelations. In addition, the concept of differential equations is explained and corresponding solution methods are discussed for simple cases.

Course Outcomes

On successful completion, students will be able to

- summarize the basic concepts of analysis.
- illustrate the terms "sequences" and "series".
- explain the concept of a function and determine the inverse function where possible.
- compute derivatives and integrals using the standard rules of differentiation and integration.
- explain the relationship between differentiation and integration.
- solve simple linear differential equations.

Contents

1. Sequences and Series
   - 1.1 Sequences: Convergence and Monotony
   - 1.2 Definition and Convergence
   - 1.3 Specific Sequences and Series
2. Functions and Inverse Functions
   - 2.1 Functions and Their Properties
   - 2.2 Exponential and Logarithmic Functions
   - 2.3 Trigonometric Functions
3. Differential Calculus
   - 3.1 First Derivative and Power Rule
   - 3.2 Differentiation Rules and Higher Derivatives
   - 3.3 Taylor Series and Taylor Polynomial

3.4 Curve Sketching
3.5 Outlook: Partial Derivatives

4. Integral Calculus
   4.1 The Indefinite Integral and Integration Rules
   4.2 The Definite Integral and the Fundamental Theorem of Calculus
   4.3 Volume and Lateral Surface of Solids of Revolution and Arc Length

5. Differential Equations
   5.1 Introduction and Basic Terms
   5.2 Solution of First-Order Linear Homogeneous Differential Equations
   5.3 Solution of First-Order Linear Non-Homogeneous Differential Equations
   5.4 Outlook: Partial Differential Equations

Literature

Compulsory Reading

Further Reading

- HELM Project (n.d.). Helping Engineers Learn Mathematics: 50 Workbooks. Available Online.
- Magnus, R. (2020). Fundamental Mathematical Analysis. Springer International Publishing.
- Pal Srimanta, & Bhunia Subodh C. (2015). Engineering Mathematics. Oxford University Press.
- Sydsæter, K., Hammond, P., Strom, A., & Carvajal, A. (2016). Essential mathematics for economic analysis (Fifth edition). Pearson Education.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Statistics Basics

Module Code: DLBSEWSG-02_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum		BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Veronica Mas (Statistics: Probability and Descriptive Statistics) / Hashem Zarafat (Statistics - Inferential Statistics)

Contributing Courses to Module

- Statistics: Probability and Descriptive Statistics (DLBDSSPDS01-01)
- Statistics - Inferential Statistics (DLBDSSIS01-01)

Module Exam Type

Module Exam	Split Exam
	Statistics: Probability and Descriptive Statistics • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Statistics - Inferential Statistics • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Statistics: Probability and Descriptive Statistics

- Probability
- Random Variables
- Joint Distributions
- Expectation and Variance
- Inequalities and Limit Theorems

Statistics - Inferential Statistics

- Point Estimation
- Uncertainties
- Bayesian Inference & Non-Parametric Techniques
- Statistical Testing
- Statistical Decision Theory

Learning Outcomes

Statistics: Probability and Descriptive Statistics

On successful completion, students will be able to

- define probability, random variable, and probability distribution.
- understand the concept of Bayesian statistics.
- grasp the definition of joint and marginal distributions.
- calculate expectation values and higher moments.
- comprehend important inequality equations and limit theorems.

Statistics - Inferential Statistics

On successful completion, students will be able to

- understand point estimation methods.
- apply maximum likelihood and ordinary least squares method to estimate parameters.
- comprehend the concept of statistical and systematic errors.
- employ error propagation methods.
- utilize Bayesian inference and non-parametric techniques.
- evaluate statistical tests.
- grasp the fundamentals of statistical decision theory.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Methods	All Bachelor Programmes in the Business & Management fields

Statistics: Probability and Descriptive Statistics

Course Code: DLBDSSPDS01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Statistical description and analysis are the foundations for data-driven analysis and prediction methods. This course introduces the fundamentals, beginning with a formal definition of probabilities and introduction to the concepts underlying Bayesian statistics.Random variables and probability density distributions are then discussed, as well as the concept of joint and marginal distributions. The importance of various discrete and continuous distributions and their applications is stressed.Characterizing distributions is an important aspect of describing the behavior of probability distributions. Students are familiarized with expectation values, variance, and covariance. The concepts of algebraic and central moments and moment-generating functions complement the characterization of probability distributions.Finally, this course focuses on important inequalities and limit theorems such as the law of large numbers or the central limit theorem.

Course Outcomes

On successful completion, students will be able to

- define probability, random variable, and probability distribution.
- understand the concept of Bayesian statistics.
- grasp the definition of joint and marginal distributions.
- calculate expectation values and higher moments.
- comprehend important inequality equations and limit theorems.

Contents

1. Probability
   - 1.1 Definitions
   - 1.2 Independent events
   - 1.3 Conditional probability
   - 1.4 Bayesian statistics
2. Random Variables
   - 2.1 Random Variables
   - 2.2 Distribution functions and probability mass functions
   - 2.3 Important discrete probability distributions
   - 2.4 Important continous probability distributions

3. Joint Distributions
   - 3.1 Joint distributions
   - 3.2 Marginal distributions
   - 3.3 Independent random variables
   - 3.4 Conditional distributions

4. Expectation and Variance
   - 4.1 Expectation of a random variable, conditional expectations
   - 4.2 Variance and covariance
   - 4.3 Expectations and variances of important probability distributions
   - 4.4 Algebraic and central moments
   - 4.5 Moment-generating functions

5. Inequalities and Limit Theorems
   - 5.1 Probability inequalities
   - 5.2 Inequalities for expectations
   - 5.3 The law of large numbers
   - 5.4 Central limit theorem

Literature

Compulsory Reading

Further Reading

- Downey, A.B. (2014). Think stats (2nd ed.). O'Reilly.
- Rohatgi, V. K., & Saleh, A. K. E. (2015). An introduction to probability and statistics. John Wiley & Sons, Incorporated.
- Triola , M.F. (2013). Elementary statistics. Pearson Education.
- Wagaman, A.S & Dobrow, R.P. (2021). Probability: With applications and R. Wiley.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Audio	☑ Online Tests
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Statistics - Inferential Statistics

Course Code: DLBDSSIS01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSSPDS01-01

Course Description

Statistical analysis and understanding are the foundations of data-driven methods and machine learning approaches.This course gives a thorough introduction to point estimators and discusses various techniques to estimate and optimize parameters. Special focus is given to a detailed discussion of both statistical and systematic uncertainties as well as propagation of uncertainties.Bayesian statistics is fundamental to data-driven approaches, and this course takes a close look at Bayesian techniques such as Bayesian parameter estimation and prior probability functions.Furthermore, this course gives an in-depth overview of statistical testing and decision theory, focusing on aspects such as A/B testing, hypothesis testing, p-values, and multiple testing which are fundamental to statistical analysis approaches in a broad range of practical applications.

Course Outcomes

On successful completion, students will be able to

- understand point estimation methods.
- apply maximum likelihood and ordinary least squares method to estimate parameters.
- comprehend the concept of statistical and systematic errors.
- employ error propagation methods.
- utilize Bayesian inference and non-parametric techniques.
- evaluate statistical tests.
- grasp the fundamentals of statistical decision theory.

Contents

1. Point Estimation
    - 1.1 Method of moments
    - 1.2 Sufficient statistics
    - 1.3 Maximum likelihood
    - 1.4 Ordinary least squares
    - 1.5 Resampling techniques
2. Uncertainties
    - 2.1 Statistical and systematic uncertainties
    - 2.2 Propagation of uncertainties

3. Bayesian Inference & Non-parametric Techniques
   - 3.1 Bayesian parameter estimation
   - 3.2 Prior probability functions
   - 3.3 Parzen windows
   - 3.4 K-nearest-neighbours

4. Statistical Testing
   - 4.1 A/B testing
   - 4.2 Hypothesis tests & test statistics
   - 4.3 P-values & confidence intervals
   - 4.4 Multiple testing

5. Statistical Decision Theory
   - 5.1 The risk function
   - 5.2 Maximum likelihood, Minimax, and Bayes
   - 5.3 Admissibility and Stein's paradox

Literature

Compulsory Reading

Further Reading

- Hogg, R. V., McKean, J., & Craig, A. T. (2020). Introduction to mathematical statistics, global edition. Pearson.
- Gutman, Alex J., Goldmeier, Jordan. (2021). Becoming a Data Head – How to Think, Speak, and Understand Data Science, Statistics, and Machine Learning. John Wiley & Sons.
- Borek Puza. (2015). Bayesian Methods for Statistical Analysis. ANU eView.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Slides	☑ Online Tests

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Review Book
☑ Recorded Live Sessions	☑ Slides	☑ Online Tests

Data Science and Object Oriented Programming with Python

Module Code: DLBSEWDSPP-01_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Ha Ngo (Introduction to Data Science) / Prof. Dr. Max Pumperla (Project: Object Oriented and Functional Programming in Python)

Contributing Courses to Module

- Introduction to Data Science (DLBDSIDS01-01)
- Project: Object Oriented and Functional Programming in Python (DLBDSOOFPP01)

Module Exam Type

Module Exam	Split Exam
	Introduction to Data Science • Study Format "Distance Learning": Advanced Workbook • Study Format "myStudies": Advanced Workbook Project: Object Oriented and Functional Programming in Python • Study Format "Distance Learning": Portfolio • Study Format "myStudies": Portfolio

Weight of Module
see curriculum

Module Contents

Introduction to Data Science

- Introduction to Data Science
- Data
- Data Science in Business
- Statistics
- Machine Learning

Project: Object Oriented and Functional Programming in Python

This course introduces the students to the advanced programming concepts of object orientation and functional programming and how they are realized in the Python programming language.

Learning Outcomes

Introduction to Data Science

On successful completion, students will be able to

- define data science and its relation to other fields.
- comprehend data science activities.
- recognize the origins of data and the challenges of working with data.
- understand how data science methods are integrated into business settings.
- grasp fundamental statistical concepts.
- appreciate the importance of machine learning in data science.

Project: Object Oriented and Functional Programming in Python

On successful completion, students will be able to

- explain basic notions in object-oriented programming such as functions and classes.
- understand object-oriented programming concepts and their relation to software design and engineering.
- describe advanced function concepts in Python.
- recognize important ideas from functional programming.
- recall important libraries for functional programming in Python.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Data Science & Artificial Intelligence	All Bachelor Programmes in the IT & Technology field

Introduction to Data Science

Course Code: DLBDSIDS01-01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Data science emerged as a multi-disciplinary field aimed at creating value from data. This course starts with an overview of data science and related fields and then defines data types and sources. Special focus is put on the assessment of data quality and electronic data processing.Use of data-driven methods has become vital for businesses, and this course outlines how data-driven approaches can be integrated within a business context and how operational decisions can be made using data-driven methods.Finally, this course highlights the importance of statistics and machine learning in the field of data science and gives an overview of relevant methods and approaches.

Course Outcomes

On successful completion, students will be able to

- define data science and its relation to other fields.
- comprehend data science activities.
- recognize the origins of data and the challenges of working with data.
- understand how data science methods are integrated into business settings.
- grasp fundamental statistical concepts.
- appreciate the importance of machine learning in data science.

Contents

1. Introduction to Data Science
   - 1.1 Definition of the term „data science“
   - 1.2 Data science and related fields
   - 1.3 Data science activities
2. Data
   - 2.1 Data types and data sources
   - 2.2 The 5Vs of data
   - 2.3 Data curation and data quality
   - 2.4 Data engineering
3. Data Science in Business
   - 3.1 Identification of use cases

3.2 Performance evaluation
3.3 Data-driven operational decisions
3.4 Cognitive biases

4. Statistics
   4.1 Importance of statistics for data science
   4.2 Important statistical concepts

5. Machine Learning
   5.1 Role of machine learning in data science
   5.2 Overview of machine learning approaches

Literature

Compulsory Reading

Further Reading

- Akerkar, R., & Sajja, P. S. (2016). Intelligent techniques for data science. Springer International Publishing.
- Hodeghatta, U. R., & Nayak, U. (2017). Business analytics using R—A practical approach. Apress Publishing.
- Runkler, T. A. (2012). Data analytics: Models and algorithms for intelligent data analysis. Springer.
- Skiena, S. S. (2017). The data science design manual. Springer International Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Project: Object Oriented and Functional Programming in Python

Course Code: DLBDSOOFPP01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Students will build upon their foundational knowledge of Python programming, by exploring advanced Python programming concepts. To this end, important notions of object-oriented programming like classes and objects and pertaining design principles are outlined. Starting from an in-depth discussion of advanced features of Python functions, functional programming concepts and their implementation in Python are conveyed.

Course Outcomes

On successful completion, students will be able to

- explain basic notions in object-oriented programming such as functions and classes.
- understand object-oriented programming concepts and their relation to software design and engineering.
- describe advanced function concepts in Python.
- recognize important ideas from functional programming.
- recall important libraries for functional programming in Python.

Contents

- Students are being provided with a thorough introduction to important notions and concepts from the domain of object-oriented programming such as classes, objects, abstraction, encapsulation, inheritance, polymorphism, composition, and delegation. Additionally, the functional programming paradigm and pertaining ideas like functions as first class objects, decorators, pure functions, immutability and higher order functions are conveyed. Pursuant to the portfolio course type, the aforementioned concepts and ideas are explored by hands-on programming projects.

Literature
Compulsory Reading
Further Reading ▪ Lott, S. F. (2018). Functional Python programming: Discover the power of functional programming, generator functions, lazy evaluation, the built-in itertools library, and monads (2nd ed.). Packt Publishing. ▪ Lutz, M. (2013). Learning Python (5th ed.). O'Reilly. ▪ Phillips, D. (2018). Python 3 object-oriented programming: Build robust and maintainable software with object-oriented design patterns in Python 3.8 (3rd ed.). Packt Publishing. ▪ Ramalho, L. (2015). Fluent Python: Clear, concise, and effective programming. O'Reilly.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Internet of Things and Embedded Systems

Module Code: DLBSEWITES_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Marian Benner-Wickner (Introduction to the Internet of Things) / Jacko Nudzor (Embedded Systems)

Contributing Courses to Module

- Introduction to the Internet of Things (DLBINGEIT01_E)
- Embedded Systems (DLBROES01_E)

Module Exam Type

Module Exam	Split Exam
	Introduction to the Internet of Things • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes Embedded Systems • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Introduction to the Internet of Things

- Internet of Things Fundamentals
- Social and Economic Significance
- Communication Standards and Technologies
- Data Storage and Processing
- Design and Development
- Applicability

Embedded Systems

- Embedded Systems Architecture
- Embedded Hardware
- Embedded Software
- Distributed Systems and IoT Architecture
- Embedded Operating Systems

Learning Outcomes

Introduction to the Internet of Things

On successful completion, students will be able to

- grasp the distinctive features of Internet of Things (IoT) and IoT systems.
- understand the social and economic importance of Internet of Things.
- identify the most important standards for communication between IoT devices.
- differentiate between various techniques for storing and processing data in IoT systems.
- identify different architectures and technologies for structuring IoT systems.
- recognize challenges of data protection and data security in IoT systems.

Embedded Systems

On successful completion, students will be able to

- understand the architecture of embedded systems.
- understand real-time embedded systems.
- design the main architecture of embedded systems for robotics, automation and IoT infrastructure.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software and Engineering	All Bachelor Programmes in the IT & Technology fields

Introduction to the Internet of Things

Course Code: DLBINGEIT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of this course is to give students an insight into technical and theoretical basics of the Internet of Things (IoT) and its fields of application. In addition to the general structure of IoT systems and the technology standards used in them, students are also taught the importance of Internet of Things for economy and society. Furthermore, this course demonstrates how data is exchanged, stored and processed in IoT.

Course Outcomes

On successful completion, students will be able to

- grasp the distinctive features of Internet of Things (IoT) and IoT systems.
- understand the social and economic importance of Internet of Things.
- identify the most important standards for communication between IoT devices.
- differentiate between various techniques for storing and processing data in IoT systems.
- identify different architectures and technologies for structuring IoT systems.
- recognize challenges of data protection and data security in IoT systems.

Contents

1. Internet of Things Fundamentals
   - 1.1 The Internet of Things - Basics and Motivation
   - 1.2 Evolution of the Internet - Web 1.0 to Web 4.0
2. Social and Economic Significance
   - 2.1 Innovations for Consumers and Industry
   - 2.2 Implications on People and the World of Work
   - 2.3 Data Protection and Data Security
3. Communication Standards and Technologies
   - 3.1 Network Topologies
   - 3.2 Network Protocols
   - 3.3 Technologies
4. Data Storage and Processing

4.1 Networked Storage with Linked Data and RDF(S)
4.2 Analysis of Networked Data using a Semantic Reasoner
4.3 Processing of Data Streams with Complex Event Processing
4.4 Operation and Analysis of Large Data Clusters using NoSQL and MapReduce

5. Design and Development
5.1 Software Engineering for Distributed and Embedded Systems
5.2 Architectural Patterns and Styles for Distributed Systems
5.3 Platforms: Microcontrollers, Monoboard Computers, One-Chip Systems

6. Applicability
6.1 Smart Home / Smart Living
6.2 Ambient Assisted Living
6.3 Smart Energy / Smart Grid
6.4 Smart Factory
6.5 Smart Logistics

Literature

Compulsory Reading

Further Reading

- Buyya, R. & Vahid Dastjerdi, A. (Hrsg.) (2016). Internet of things. Principles and paradigms. Morgan Kaufmann, Cambridge (MA).
- Dian, F. J., & Vahidnia, R. (2020). IoT use cases and technologies. British Columbia Institute of Technology.
- Firouzi, F., Chakrabarty, K., & Nassif, S. (2020). Intelligent Internet of Things: From device to fog and cloud. Springer.
- Gilchrist, A. (2016). Industry 4.0. The industrial internet of things. Apress.
- Raj, P., & Raman, A. C. (2017). The Internet of things: enabling technologies, platforms, and use cases. CRC Press.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Embedded Systems

Course Code: DLBROES01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

To realize working engineering systems, embedded systems are required. Through embedding microprocessor-based systems capable of networking, data exchange and processing, the functionality of products and systems can be enhanced in terms of features, precision, accuracy, dynamic properties, intelligence. Actually, an embedded system is where everything begins. This course provides the basics on embedded system, by focusing on the architectural patterns of modern systems and platforms. The embedded hardware and software aspects are addressed. This course also introduces connectivity and networking aspects, which are required to build distributed systems for the internet of things and the industrial internet of things (finally yielding Cyber-Physical Systems).

Course Outcomes

On successful completion, students will be able to

- understand the architecture of embedded systems.
- understand real-time embedded systems.
- design the main architecture of embedded systems for robotics, automation and IoT infrastructure.

Contents

1. Introduction
   - 1.1 Embedded Systems Overview
   - 1.2 Hardware Elements of an Embedded System
   - 1.3 Standards, Compilers and Programming Languages
2. Elements of a Microcontroller
   - 2.1 Central Processing Units
   - 2.2 Volatile and non-volatile memory
   - 2.3 Digital/Analog Input/Output
   - 2.4 Timing peripherals
   - 2.5 Communication peripherals
3. Programming a Microcontroller

3.1 Bone Structure of a Microcontroller Software
3.2 Low-Level Programming
3.3 Usage of Middle-Level Libraries
3.4 Common IDEs and Tools

4. Embedded Operating Systems
   4.1 Task Management
   4.2 Scheduler
   4.3 Examples of Embedded Operating Systems

5. Distributed Systems and IoT Architecture
   5.1 Network Interfaces
   5.2 The Internet Protocol
   5.3 Examples of Distributed Systems

Literature

Compulsory Reading

Further Reading

- Noergaard, T. (2013). Embedded systems architecture: A comprehensive guide for engineers and programmers (2nd ed.). Newnes.
- White, E. (2011). Making embedded systems: Design patterns for great software. O'Reilly Media.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Robotics and Production Engineering

Module Code: DLBSEWRI-01_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Ha Ngo (Introduction to Robotics) / Prof. Dr. Hans Kerwat (Production Engineering Industry 4.0)

Contributing Courses to Module

- Introduction to Robotics (DLBROIR01-01_E)
- Production Engineering Industry 4.0 (DLBDSEAR01)

Module Exam Type

Module Exam	Split Exam
	Introduction to Robotics • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Production Engineering Industry 4.0 • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Introduction to Robotics

- Introduction to Robotics
- Trends
- Industrial Robots
- Mobile Robots
- Applications

Production Engineering Industry 4.0

- Introduction to Manufacturing Technology
- Main Production Groups According to DIN 8580
- Additive Manufacturing Processes
- Rapid Prototyping
- Rapid Tooling
- Direct/Rapid Manufacturing
- Cyber-Physical Production Plants

Learning Outcomes

Introduction to Robotics

On successful completion, students will be able to

- name important developments in the field of robotics.
- understand the mechanical structure and characteristics of robots.
- name characteristics and challenges of industrial robots.
- name characteristics and challenges of mobile robots.
- understand the role of robots in applications.
- name and understand current trends in the field of robotics.

Production Engineering Industry 4.0

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Engineering and Computer Science & Software Development	All Bachelor Programmes in the IT & Technology field

Introduction to Robotics

Course Code: DLBROIR01-01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Robotics is experiencing very interesting developments, which experts describe as being a transition to a new generation of robots. We have moved from the "4Ds" of Robotics 1.0 (dull, dirty, dumb, dangerous) to the "4Ss" of Robotics 2.0 (smarter, safer, sensors, simple), but we still need to proceed further to the "4Ms" of Robotics 3.0 (multitasking, emotive, morphing, multiagent). This course, thus, provides the required background to understand the main development of robotics looking at industrial as well as at mobile robots, their main characteristics, issues, challenges, applications, and development trends.

Course Outcomes

On successful completion, students will be able to

- name important developments in the field of robotics.
- understand the mechanical structure and characteristics of robots.
- name characteristics and challenges of industrial robots.
- name characteristics and challenges of mobile robots.
- understand the role of robots in applications.
- name and understand current trends in the field of robotics.

Contents

1. What is Robotics?
   - 1.1 Basics and Definitions
   - 1.2 History and Cultural Influence
   - 1.3 Challenges and Trends (from Robotics 1.0 to Robotics 3.0)
2. Robots
   - 2.1 Mechanical Structure
   - 2.2 Kinematic Chains
   - 2.3 Market Overview
3. Industrial Robots
   - 3.1 Components of Industrial Robot Systems
   - 3.2 Characteristics

3.3 Common Industrial Robots
3.4 Applications
3.5 Trends

4. Mobile Robots
   4.1 Components of Mobile Robot Systems
   4.2 Characteristics
   4.3 Common Mobile Robots
   4.4 Applications
   4.5 Trends

5. Applications
   5.1 Industrial Robots
   5.2 Healthcare
   5.3 Agriculture or Field Robotics
   5.4 Space and Defense
   5.5 Warehouse and Logistics
   5.6 Construction
   5.7 Wearables
   5.8 Social Robots

Literature

Compulsory Reading

Further Reading

- Mihelj, M., Bajd, T., Ude, A., Lenarcic, J., Stanovnik, A., Munih, M., Rejc, J., & Slajpah, S. (2019). Robotics(2nd ed.). Springer.
- Ben-Ari, M., & Mondada, F. (2017). Elements of robotics. Springer.
- Siciliano, B., & Khatib, O. (Eds.). (2016). Springer handbook of robotics. Springer

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Production Engineering Industry 4.0

Course Code: DLBDSEAR01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of the course is to provide students with an overview of the processes that have influenced and still influence production processes through technological developments under the generic term Industry 4.0, based on traditional, standardized manufacturing techniques. These include, in particular, technological advances in additive manufacturing processes that enable applications such as rapid prototyping, rapid tooling, and direct manufacturing. Finally, the course deals with the consequences of the digitalization and networking of production facilities and their elements in the sense of a cyber-physical system.

Course Outcomes

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Contents

1. Introduction to Manufacturing Technology
    - 1.1 Basic Terms and Contexts in Manufacturing Theory
    - 1.2 Historical Development of Production
    - 1.3 The Discussion About the Long Tail
2. Classification Of Manufacturing Processes
    - 2.1 Casting and Molding
    - 2.2 Forming
    - 2.3 Machining
    - 2.4 Joining

- 2.5 Coating
- 2.6 Changing the Properties of Substances

3. Additive Manufacturing Processes
   - 3.1 Basic Principles and Legal Aspects
   - 3.2 Stereolithography (STL)
   - 3.3 Selective Laser Sintering and Selective Beam Melting With Laser or Electron Beam
   - 3.4 Fused Deposition Modeling (FDM)
   - 3.5 Multi-Jet Modeling (MJM) and Poly-Jet Process (PJM)
   - 3.6 3D Printing Process (3DP)
   - 3.7 Laminating Processes
   - 3.8 Mask Sintering

4. Rapid Prototyping
   - 4.1 Definition
   - 4.2 Strategic and Operational Aspects
   - 4.3 Application Areas and Examples

5. Rapid Tooling
   - 5.1 Definition, Strategic, and Operational Aspects
   - 5.2 Indirect and Direct Procedures

6. Direct/Rapid Manufacturing
   - 6.1 Potentials and Requirements for Procedures
   - 6.2 Implementation, Application Areas, and Examples

7. Cyber-Physical Production Plants
   - 7.1 Derivation of the Terms Industry 4.0 and Cyber-Physical Systems
   - 7.2 Megatrend Cyber Physical Systems (CPS)
   - 7.3 Definition Cyber-Physical Production Plant
   - 7.4 Effects on Planning and Operation of Production Facilities
   - 7.5 Dynamic Reconfiguration and Migration of Production Facilities

Literature
Compulsory Reading
Further Reading ▪ Anderson, C. (2012). Makers: The new industrial revolution. Crown Business. ▪ Gebhardt, A., Kessler, J. & Thurn, L. (2019). 3D printing: Understanding additive manufacturing (2nd ed). Hanser. ▪ Groover, M. P. (2012). Fundamentals of modern manufacturing: Materials, processes, and systems (5th ed.). Wiley.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Practice Exam
- ☑ Online Tests

International Management and Leadership

Module Code: DLBSEWIML_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Jonathan Black-Branch (International Management) / Simon Fischer (Leadership 4.0)

Contributing Courses to Module

- International Management (BWINT01)
- Leadership 4.0 (DLBWPLS01_E)

Module Exam Type

Module Exam	Split Exam
	International Management • Study Format "Duales myStudium": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes • Study Format "On Campus": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Leadership 4.0 • Study Format "Duales myStudium": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

International Management

- Globalization and the internationalization of business
- Assessment of political, legal, economic, and cultural Contexts
- Strategy in international business
- Organization in international business
- Marketing in international business
- Human resource management in international business

Leadership 4.0

- Conventional understanding of leadership
- Management tools
- Leadership versus management
- Integral concept of humankind as future-oriented model
- Characteristics and competencies of leaders
- Leadership models
- Agile Leadership instruments

Learning Outcomes

International Management

On successful completion, students will be able to

- recognize and explain the cultural, social, economic, historical, and political differences that affect strategic decision making on an international/global scale.
- gather specific information and conduct reliable assessments of the opportunities and risks related to business activities in different geographical market regions and specific national markets.
- describe the impact of culture on international business activities.
- identify different options for market entry and market development and participate in strategic planning activities that address these issues.
- design and evaluate different organizational structures for international businesses and design measures to optimize organizational structures for international operations.
- design, evaluate, and optimize human resource management practices for global and multinational companies.
- explain options for international marketing and select an appropriate marketing mix relative to specific products/services and the target market.
- identify and manage challenges associated with operating in an international/global business environment, such as the procurement and coordination of resources and human resource management.
- develop business plans that implement specific organizational, marketing, and distribution strategies in selected regions/countries.

Leadership 4.0

On successful completion, students will be able to

- understand the classical theories of leadership and new leadership models.
- distinguish between the terms leadership and management.
- reflect on the understanding of successful leadership models against the background of economic changes.
- develop an understanding of the need for alternative forms of organizational directing.
- implement appropriate leadership methods according to a company's level of complexity.
- draw upon a sound theoretical understanding that they can practice in applied research.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Business Administration & Management	All Bachelor Programs in the Business & Management field

International Management

Course Code: BWINT01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Globalization presents multiple opportunities and challenges to product and service industries. Many companies previously engaged in local markets must consider global trends and international markets, both on the demand and on the supply side. With this, comes new opportunities to market products and services. At the same time, complexity in daily business increases and managers have to face ambiguities and frequently changing contexts. With more competition, more diverse markets, and cultural, political, and legal challenges abroad, it has become more difficult to manage a company efficiently. All these factors call for managers to adopt a global mindset and sufficient cultural sensitivity.The course is designed to cover the economic, organizational, and cultural underpinnings that students need to grasp in order to better understand the managerial challenges that global organizations of all types and sizes have to cope with. Participants of this course will be provided with empirical knowledge and first-hand experiences of international management. Through multiple case studies within the course book, online lectures, and tutorials, students will develop a detailed understanding of the strategies and operational patterns necessary to successfully operate in international markets.

Course Outcomes

On successful completion, students will be able to

- recognize and explain the cultural, social, economic, historical, and political differences that affect strategic decision making on an international/global scale.
- gather specific information and conduct reliable assessments of the opportunities and risks related to business activities in different geographical market regions and specific national markets.
- describe the impact of culture on international business activities.
- identify different options for market entry and market development and participate in strategic planning activities that address these issues.
- design and evaluate different organizational structures for international businesses and design measures to optimize organizational structures for international operations.
- design, evaluate, and optimize human resource management practices for global and multinational companies.
- explain options for international marketing and select an appropriate marketing mix relative to specific products/services and the target market.
- identify and manage challenges associated with operating in an international/global business environment, such as the procurement and coordination of resources and human resource management.
- develop business plans that implement specific organizational, marketing, and distribution strategies in selected regions/countries.

Contents

1. Introduction to International Management
   - 1.1 What is Globalization?
   - 1.2 Facts about Globalization and the Global Economy
   - 1.3 Theoretical Explanations for Globalization
2. The International Company and its Environment
   - 2.1 International Companies and their Operations
   - 2.2 Operational Patterns in International Markets
   - 2.3 Assessment of the Environment for Internalization
3. Culture and International Business
   - 3.1 A Generic Perspective on Culture
   - 3.2 Organizational Culture
   - 3.3 Cultural Diversity and the Contemporary Manager
4. Strategy Development in International Business
   - 4.1 Strategy in Globalized Business Operations
   - 4.2 Strategy Concepts and Strategic Options

4.3 Managing Strategy

5. International Human Resource Management
   - 5.1 Characteristics of International Human Resource Management
   - 5.2 The Global Manager
   - 5.3 Instruments in International Human Resource Management

6. Organization in International Business
   - 6.1 Traditional Perspectives on Business Organization
   - 6.2 Modern Views on Business Organization
   - 6.3 Coordination of Intra-Organization Collaboration

7. International Marketing
   - 7.1 Marketing in International Business
   - 7.2 Strategic Choices in International Marketing
   - 7.3 Marketing Mix Choices in International Marketing

Literature

Compulsory Reading

Further Reading

- Deresky, H. (2016). International management (9th ed.). Harlow: Prentice Hall International
- Collinson, C., Narula, R., and Rugma, Alan.M. (2020). International Business, 8th edition Pearson.
- Peng, M. W., & Meyer, K. (2023). International business. (4th ed.) London: Cengage Learning Emea.
- Daniels, J. D., Radebaugh, L. H., & Sullivan, D. P. (2019). International business: Environments and Operations (16th ed.). Harlow: Pearson.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format On Campus

Study Format	Course Type
On Campus	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Leadership 4.0

Course Code: DLBWPLS01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Today, competitiveness depends more than ever on continuous innovation. This puts new demands on the management of companies. The task of successful leaders in innovation and business is no longer to offer direction and solutions, but to create a framework in which others develop innovations. This change, which is currently taking place with full force in companies, requires further developments on classic leadership concepts and its principles.Against the background of digital change and the advance of artificial intelligence, established business models are constantly being put to the test. On the one hand, it is important to work on several projects simultaneously and to adapt flexibly to changing conditions at any time; on the other hand, employees want to be integrated into the work process in a different way. Consideration and flexibility for their personal and family situation play an increasing role. Innovation and business leaders can only meet all these diverse challenges with Leadership by inspiring others to think ahead and act inter-divisionally, in other words, to be visionary. This course tries to convey knowledge, understanding and tools for this challenging field of work.

Course Outcomes

On successful completion, students will be able to

- understand the classical theories of leadership and new leadership models.
- distinguish between the terms leadership and management.
- reflect on the understanding of successful leadership models against the background of economic changes.
- develop an understanding of the need for alternative forms of organizational directing.
- implement appropriate leadership methods according to a company's level of complexity.
- draw upon a sound theoretical understanding that they can practice in applied research.

Contents

1. Basics of the Leadership Concept
    - 1.1 Definition of the Leadership Concept and Leadership Actions
    - 1.2 Development of the Understanding of Leadership
    - 1.3 The Role of Communication in Leadership
    - 1.4 New Challenges for Leadership
2. Leadership Versus Management

2.1 Distinctions between these Concepts
2.2 Relevance of Leadership in the Context of Technological Change
2.3 New Forms of Work as a Challenge for Leadership 4.0

3. Organizational Prerequisites for Successful Leadership
3.1 Launching Corporate Governance Initiatives
3.2 From Process to Project Management
3.3 Managing Limited Resources

4. Personal Factors for Successful Leadership
4.1 Personal Characteristics
4.2 Technological Know-how
4.3 Policy and Compliance

5. Management Tools
5.1 Definition, Differentiation and Challenges
5.2 Use of Direct Management Tools
5.3 Use of Indirect Management Tools

6. Leadership 4.0 Models
6.1 Transformational Leadership
6.2 Leadership as an Agile Role
6.3 Authentic Leadership

7. Leadership 4.0 Case Studies
7.1 Allsafe Jungfalk
7.2 Automattic

Literature

Compulsory Reading

Further Reading

- Seliger, R (2022): Positive Leadership. The Management revolution, Schäffer-Poeschel, Freiburg
- Luthans, F. (2021): Organizational Behavior: An Evidence-Based Approach, 14th Edition. Charlotte, NC : Information Age Publishing.
- Helmod, M. (2021): New Work, Transformational and Virtual Leadership: Lessons from Covid-19 and other crisis, Springer, Wiesbaden.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

International Marketing and Branding

Module Code: DLBDSEIMB

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Josephine Zhou-Brock (International Marketing) / Prof. Dr. Josephine Zhou-Brock (International Brand Management)

Contributing Courses to Module

- International Marketing (DLBDSEIMB01)
- International Brand Management (DLBDSEIMB02)

Module Exam Type

Module Exam	Split Exam
	International Marketing • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "Duales myStudium": Exam, 90 Minutes International Brand Management • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

International Marketing

- International marketing strategy
- Cultural differences and their significance for marketing
- International marketing mix (product, price, promotion, and distribution decisions in an international environment)
- International market research and consumer behavior
- Ethical aspects in international marketing
- International marketing controlling and six sigma

International Brand Management

- Basics of brand management
- Framework conditions for brands in international markets
- Strategies and concepts of international brands
- Brand architectures and brand extension options
- Brand management and communication
- Brand management according to the stakeholder concept
- Brand control and protection

Learning Outcomes

International Marketing

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

International Brand Management

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

International Marketing

Course Code: DLBDSEIMB01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Students are taught the necessity for strategic marketing in an international context. They will learn about essential cultural differences and their influences on international marketing management. The basic decisions, standardizations, and adaptations in international marketing are experienced by the students on the basis of different concepts in the international marketing mix. The necessity of international market research, strategic planning, and control are taught to the students, along with the ethical aspects in international marketing. The students analyze current topics in international marketing management and reflect on them in connection with the concepts they have learned in this course.

Course Outcomes

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

Contents

1. Strategic International Marketing
   - 1.1 Internationalization
   - 1.2 Theoretical Foundations of International Market Entry Strategies
   - 1.3 Forms of International Market Entry
2. Cultural Differences as an Aspect of International Marketing
   - 2.1 Overview of Culture
   - 2.2 Cultural Model Based on Hofstede
   - 2.3 Cultural Model Based on Trompenaars
3. Case Studies in International Market Entry and Marketing Strategies
   - 3.1 Case Study: Nivea in South Korea

3.2 Case Study: Bosch and Siemens Hausgeräte GmbH in China
3.3 Case Study: Siemens Mobile in China
3.4 Case Study: Siemens in China

4. International Product Management and Product Development
4.1 Goals of International Product Management
4.2 Framework Conditions for International Product Management
4.3 International Product Decisions
4.4 International Product Development

5. Exchange Rate Fluctuations and International Price Calculation
5.1 Tasks and Objectives of International Price Management
5.2 Factors Influencing International Price Management
5.3 Instruments of International Price Management

6. International Communication and International Sales Policy
6.1 International Communication Management
6.2 International Sales Management

7. International Marketing and Ethics
7.1 Overview of International Marketing and Ethics
7.2 Business Ethics in International Companies
7.3 Case Study: Nestlé

8. Applied Market Research and Its Influence on Consumer Behavior
8.1 Scope of International Market Research
8.2 Requirements for International Market Research Information
8.3 International Secondary Research
8.4 International Primary Research

9. Monitoring and Control in International Marketing
9.1 Controlling in International Management

10. Six Sigma, Brand Management, and Rebranding
10.1 Six Sigma: Basics, Definitions, and Processes
10.2 Brand Management
10.3 Rebranding

Literature
Compulsory Reading
Further Reading ▪ Armstrong, G., Kotler, P., & Opresnik, M. O. (2019). Marketing: An introduction (14th ed.). Pearson. ▪ Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). Cultures and organizations—Software of the mind: Intercultural cooperation and its importance for survival. McGraw-Hill. ▪ Hollensen, S. (2020). Global marketing (8th ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Practice Exam
- ☑ Online Tests

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

International Brand Management

Course Code: DLBDSEIMB02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of this course is to deepen and expand the knowledge acquired in the introductory elective course International Marketing. The value of a brand is a decisive competitive advantage for companies in international business. Brands create long-term and profitable customer relationships. Brands are therefore valuable assets for companies and organizations. Students learn the basics of brand management before moving on to the concepts and success factors of international brand management. Students also become familiar with the structure of brand architectures and the possibilities of brand extensions. The fact that different stakeholder groups must be taken into account in brand management is communicated to the students on the basis of the stakeholder concept. In addition, the students get to know the various methods for measuring brand value and brand controlling. The aspects of trademark protection that are particularly important in an international environment will be dealt with conclusively.

Course Outcomes

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Contents

1. Basics of Brand Management
    - 1.1 Brand Significance and Brand Understanding
    - 1.2 Market Conditions
    - 1.3 Tasks and Goals of Brand Management
2. Brand Identity, Brand Positioning, and Brand Personality
    - 2.1 Brand Identity as the Basis of Brand Management

2.2 Brand Positioning
2.3 Brand Image
2.4 Brand Personality

3. Brand Strategies
3.1 The Challenges for Brand Strategies
3.2 Brand Strategies for New Products
3.3 Trademark Licensing

4. International Branding
4.1 Importance of Branding for International Companies
4.2 Brand Concepts for International Brands
4.3 Factors for Successful International Brands

5. Brand Architectures and Types of Branding
5.1 Brand Hierarchies
5.2 Co-branding and Ingredient Branding

6. Brand Management and Communication
6.1 Classic Brand Communication
6.2 Brand Communication on the Internet

7. Brand Expansion
7.1 Basics of Brand Extension
7.2 Opportunities and Risks of Brand Extension
7.3 Ideal Typical Sequence of the Brand Extension Process

8. Brand Management According to the Stakeholder Concept
8.1 Basics of Brand Management According to the Stakeholder Principle
8.2 Stakeholder Groups: Consumer Stakeholder Groups
8.3 Stakeholder Groups: Shareholders and Financial Investors
8.4 Stakeholder Groups: Employees
8.5 Stakeholder Groups: Suppliers and the Public

9. Brand Control
9.1 Basics of Brand Controlling
9.2 Importance and Measurement of Brand Value
9.3 Practical Methods for Measuring Brand Value

10. Trademark Protection
    - 10.1 Object of Trademark Protection
    - 10.2 Origin of Trademark Protection
    - 10.3 Trademark Infringements

Literature

Compulsory Reading

Further Reading

- Beverland, M. (2021). Brand management: Co-creating meaningful brands (2nd ed.). SagePublications Ltd.
- Burmann, C., Riley, N. M., Halaszovich, T., & Schade, M. (2017). Identity-based brand management:Fundamentals—strategy—implementation—controlling. Springer Gabler.
- Kapferer, J. N. (2012). The new strategic brand management: Advanced insights and strategicthinking (5th ed.). Kogan Page.
- Keller, K. L., & Swaminathan, V. (2019). Strategic brand management: Building, measuring, andmanaging brand equity (5th ed., Global ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Applied Sales

Module Code: DLBDSEAS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Tanja Moehler (Applied Sales I) / Tanja Moehler (Applied Sales II)

Contributing Courses to Module

- Applied Sales I (DLBDSEAS01)
- Applied Sales II (DLBDSEAS02)

Module Exam Type

Module Exam	Split Exam
	Applied Sales I • Study Format "Distance Learning": Exam, 90 Minutes Applied Sales II • Study Format "Distance Learning": Exam or Advanced Workbook, 90 Minutes

Weight of Module

see curriculum

Module Contents

Applied Sales I

- Fundamentals of Applied Sales
- The Distribution System
- Personal Sales
- Sales Plans
- New Customer Acquisition
- A Sales Visit
- Conversational Tactics
- Conducting Negotiations
- Other Sales Channels

Applied Sales II

- Marketing and Sales
- Customer Satisfaction as a Success Factor
- Personalities in Sales
- Customer-Oriented Communication
- Presentation and Rhetoric
- Customer Loyalty
- Networking
- Case Study

Learning Outcomes

Applied Sales I

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Applied Sales II

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

Applied Sales I

Course Code: DLBDSEAS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The demands on sales thinking are growing every day. Globalized demand combined with high competition is making it increasingly difficult for companies to compete for customers. At the same time, customers are becoming better informed, while traditional supply markets are saturated and at overcapacity. In order to be successful in such an environment, sales thinking and action are required along with a new type of salesperson. Within the course Applied Sales I (Introduction), the participants are familiarized with the basic concepts of applied sales. You will learn about sales organization, dealing with alternative sales channels, and get to know the dedicated sales planning process. The contents of the module are complemented by the successful acquisition of new customers, whereby particular attention is paid to the organization and implementation of customer visits and the conduct of discussions and negotiations.

Course Outcomes

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Contents

1. Fundamentals of Applied Sales and Distribution
    - 1.1 Tasks and Forms of Applied Distribution
    - 1.2 Marketing as the Basis of Sales
    - 1.3 Distribution, Sales, and Other Terms
    - 1.4 Sales in Different Economic Sectors
2. The Distribution System

2.1 Forms of Sales
2.2 Sales Organisation
2.3 Key Account Management
2.4 Multi-Channel Distribution

3. Personal Sales
3.1 The "New Sellers"
3.2 Requirements for Sales Personalities
3.3 The Key Account Manager
3.4 Task of Sales Managers

4. Sales Plan
4.1 Tasks and Objectives of Sales Management
4.2 Observation of Competition in the Context of Sales Management
4.3 Potential Analyses and Sales Planning
4.4 Sales Control and Visit Strategies

5. New Customer Acquisition
5.1 Identification of New Customer Potential
5.2 Customer Relationship Management and Customer Acquisition
5.3 Trade Fairs and Events
5.4 Networking

6. The Sales Visit
6.1 Frequency and Preparation of Visits
6.2 Conduct of a Visit
6.3 Visit Reports and Follow-Up
6.4 Aftercare and Follow-Up

7. Conversational Tactics
7.1 Structured Conversation Preparation
7.2 Goal-Oriented Conversation: The D.A.L.A.S Model
7.3 Questioning Techniques

8. Conducting Negotiations
8.1 Psychology of Negotiation
8.2 Negotiation Structure
8.3 Objection Handling
8.4 Price Negotiations

9. Other Sales Channels
   - 9.1 Telemarketing
   - 9.2 Catalogue and Brochure Sales
   - 9.3 Internet and E-Commerce

Literature

Compulsory Reading

Further Reading

- Bloomfield, J. (2020). NeuroSelling: Mastering the customer conversation using the surprising science of decision making. Axon Publishing.
- Jobber, D., Lancaster, G., & Le Meunier-FitzHugh, K. (2019). Selling and sales management (10th ed.). Pearson.
- Peppers, D., & Rogers, M. (2016). Managing customer experience and relationships: A strategic framework (3rd ed.). Wiley.
- Pink, D. H. (2012). To sell is human: The surprising truth about moving others. Riverhead Books.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Applied Sales II

Course Code: DLBDSEAS02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The course Applied Sales II builds on the basics taught in the course "Applied Sales I" and broadens and deepens them. First, the tension between marketing and sales is examined in more detail. Based on this, essential backgrounds and central target figures for successful sales management (e.g., customer satisfaction and loyalty as well as the customer life cycle) are derived and operationalized in order to create the basis for efficient and effective customer relationship management. As the process progresses, attention will also be paid to mental processes and consumer behavior in general. In addition, strategies and paths to successful negotiation are deepened and supplemented by convincing communication techniques. The course concludes with a case study in the course of which the students have the opportunity to apply what they have learned in a practice-oriented manner.

Course Outcomes

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Contents

1. Marketing and Sales
    - 1.1 Marketing and Business Philosophy
    - 1.2 Sales Marketing in Different Economic Sectors
    - 1.3 Relationship Marketing

- 1.4 (International) Marketing and Sales Integration

2. Customer Satisfaction as a Success Factor
   - 2.1 Customer Relationship Management (CRM)
   - 2.2 Customer Orientation Success Chain
   - 2.3 Customer Relationship Strategies

3. Customer Retention
   - 3.1 Customer Retention Management
   - 3.2 Customer Retention Tools
   - 3.3 Complaints Management

4. Customer-Oriented Communications
   - 4.1 Communication and Sales Promotion by Sales Staff
   - 4.2 Sales Promotion by Sales Team
   - 4.3 Sales Promotion by the Company

5. Personalities in Sales
   - 5.1 Sales Personalities
   - 5.2 Selling in Teams
   - 5.3 Negotiating with Committees

6. Presentation and Rhetoric
   - 6.1 Rhetoric in Sales
   - 6.2 Presentation Techniques
   - 6.3 Nonverbal Communication

7. Networking
   - 7.1 Organizational Networks and Networking
   - 7.2 Building and Shaping Relationships
   - 7.3 Networking via Social Media

8. Case Study—Multi-Vendor Customer Loyalty Programs
   - 8.1 German Consumer Goods Market & Drugstore Industry Situation
   - 8.2 PAYBACK—A German Synonym for Loyalty Cards

Literature
Compulsory Reading
Further Reading ▪ Homburg, C., Schäfer, H., & Schneider, J. (2012). Sales excellence: Systematic sales management. Springer Science & Business Media. ▪ Ingram, T. N., Schwepker, C. H., Williams, M. R., Avila, R. A., & LaForge, R. W. (2020). Salesmanagement: Analysis and decision making (10th ed.). Routledge, Taylor & Francis Group. ▪ Kotler, P., & Keller, K. L. (2021). Marketing management (16th, global ed.). Pearson Education.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Supply Chain Management

Module Code: DLBDSESCM

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Alex Leberling (Supply Chain Management I) / N.N. (Supply Chain Management II)

Contributing Courses to Module

- Supply Chain Management I (DLBDSESCM01)
- Supply Chain Management II (DLBDSESCM02)

Module Exam Type

Module Exam	Split Exam
	Supply Chain Management I • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Supply Chain Management II • Study Format "myStudies": Exam or Advanced Workbook, 90 Minutes • Study Format "Distance Learning": Exam or Advanced Workbook, 90 Minutes

Weight of Module

see curriculum

Module Contents

Supply Chain Management I

- Historical and terminological aspects of the SCM concept
- Motives for the creation of cross-company value creation networks
- Design principles and effects of value creation networks
- Logistical core processes and SCM
- Information technology aspects of the SCM concept
- Coordination and collaboration of the network partners
- Industry-specific solutions of the SCM

Supply Chain Management II

- Strategic aspects of SCM
- SCM Practice: Tasks and Activities in the Core Planning Process
- SCM Practice: Tasks and Activities in the Core Process of Procurement
- SCM Practice: Tasks and Activities in the Core Process Production
- SCM Practice: Tasks and Activities in the Core Distribution Process

Learning Outcomes

Supply Chain Management I

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Supply Chain Management II

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fields of Logistics & Transportation	All Bachelor Programmes in the Transport & Logistics fields

Supply Chain Management I

Course Code: DLBDSESCM01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

SCM proves to be an extremely multi-faceted construct from both a theoretical and a practical point of view. An adequate understanding of the problem dimensions and modes of action of (global) cross-company value creation networks requires a multidimensional approach. It starts by considering logistical processes, with modern process, flow, and network standards forming an important basis for SCM. On the basis of such an approach, students should gain a fundamental understanding of SCM. From the point of view of a holistic approach, it also makes sense to also examine a number of other typical problem areas in addition to the logistical challenges of this concept. This includes IT aspects of SCM (e.g., APS systems), and questions to do with the collaboration and coordination of network partners. This course also considers selected industry specific SCM solutions (ECR or VMI).

Course Outcomes

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Contents

1. Fundamentals of the Supply Chain Concept
    - 1.1 Terminological and Conceptual Fundamentals
    - 1.2 Supply Chain Typology According to Otto
    - 1.3 Supply Chain Typology According to Bechtel/Jayaram
    - 1.4 Dynamic Aspects of Supply Chains

2. Selected Theoretical Concepts for the Supply Chain Concept
   - 2.1 New Institutional Economics
   - 2.2 Game Theory
   - 2.3 Network Approach
   - 2.4 Other Theoretical Additions

3. Supply Chain Management
   - 3.1 Basic Information on the Goals and Scope of SCM
   - 3.2 Popular Problem Areas of the SCM
   - 3.3 Supply Chain Management as an Evolutionary Step in Logistics
   - 3.4 Supply Chain Management as Cooperation Management

4. SCM Model
   - 4.1 Basic Information on the Term SCM Models
   - 4.2 SCOR Model
   - 4.3 SCM Task Model

5. SCM as a Coordination Problem
   - 5.1 Basic Information on the Concept of Coordination
   - 5.2 Coordination Concepts, Context, and Perspectives of SCM
   - 5.3 Coordination Instruments

Literature

Compulsory Reading

Further Reading

- Bowersox, J., Closs, D., & Cooper, M. B. (2020). Supply chain logistics management (5th ed.). McGraw Hill Education.
- Chopra, S., & Meindl, P. (2019). Supply chain management: Strategy, planning, and operation (7th ed., Global ed.). Pearson Education.
- Es-Satty, Asmaa; Lemghari, Radouane; Okar, Chafik. (2020). Supply Chain Digitalization Overview SCOR model implication. In: 2020 IEEE 13th International Colloquium of Logistics and Supply Chain Management (LOGISTIQUA) Logistics and Supply Chain Management (LOGISTIQUA), 2020 IEEE 13th International Colloquium of. :1-7 Dec, 2020; IEEE Language: English, Datenbank: IEEE Xplore Digital Library.
- Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of enhanced enterprise resource planning (ERP) on firm performance through green supply chain management. Sustainability, 13(8), article 4358.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Supply Chain Management II

Course Code: DLBDSESCM02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

From the perspective of strategic management research and practice, the activities covered by the term SCM are closely related to efforts to build and/or maintain a stable operational competitive advantage. A fundamental discussion of this relationship forms the starting point for the course. On this basis, a differentiated analysis of strategy-relevant activities and instruments in the Plan, Source, Make, Deliver, and Return process categories is then carried out using the SCOR model. Special attention is given to the practice-relevant areas of SCM, e.g., order-promising (plan), supplier-relation-management (source), postponement (make), and the ECR-concept (deliver).

Course Outcomes

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Contents

1. Strategic Aspects of SCM
   - 1.1 Strategic Thinking and Action: General Information
   - 1.2 Competition Focus and SCM
   - 1.3 Competition Location and SCM
   - 1.4 Competition Rules and SCM

2. SCM Practice: Core Process Planning
   - 2.1 General Preliminary Considerations
   - 2.2 Collaborative Planning, Forecasting, and Replenishment
   - 2.3 Order Promoting

2.4 Kanban
2.5 Integration of X-PL Logistics Service Providers

3. SCM Practice: Core Process Procurement
   3.1 General Preliminary Considerations
   3.2 Production Synchronous Procurement
   3.3 Sourcing Concepts
   3.4 Supplier Relations Management

4. SCM Practice: Core Process Production
   4.1 Selected Aspects of the Problem Background
   4.2 Collaborative Engineering
   4.3 Postponement Strategies
   4.4 Value Added Partnership

5. SCM Practice: Core Process Distribution
   5.1 Basic Information on the Distribution Problem
   5.2 Efficient Consumer Response (ECR)
   5.3 Consignment Warehouse

Literature

Compulsory Reading

Further Reading

- Chopra, S. (2019). Supply chain management: Strategy, planning and operation (Global ed., 7th ed.). Pearson.
- Hill, A., & Hill, T. (2018). Essential operations management (2nd ed.). Palgrave.
- Hugos, M. (2011). Essentials of supply chain management (3rd ed.). John Wiley & Sons.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Business Intelligence

Module Code: DLBCSEBI

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimaldauer: 1 Semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Maik Drozdzynski (Business Intelligence) / Prof. Dr. Neil Arvin Bretana (Project: Business Intelligence)

Contributing Courses to Module

- Business Intelligence (DLBCSEBI01)
- Project: Business Intelligence (DLBCSEBI02)

Module Exam Type

Module Exam	Split Exam
	Business Intelligence • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Project: Business Intelligence • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Business Intelligence

- Motivation and Conceptualization
- Data Provision
- Data Warehouse
- Modeling of Multidimensional Data Spaces
- Analysis Systems
- Distribution and Access

Project: Business Intelligence

Possible topics for the BI project include “Management of BI projects”, “Design of multidimensional data models” and “Prototypical implementation of small BI applications”.

Learning Outcomes

Business Intelligence

On successful completion, students will be able to

- explain the motivation, use cases, and basics of Business Intelligence.
- identify and explain techniques and methods for providing and modeling data, as well as types of data relevant to BI, differentiating between them.
- explain techniques and methods for the generation and storage of information and independently select suitable methods on the basis of concrete requirements.

Project: Business Intelligence

On successful completion, students will be able to

- independently design a solution to a practical problem in the field of Business Intelligence in order to then implement a prototype and document the results.
- identify and explain typical problems and challenges in the design and practical implementation of small BI solutions.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programmes in the IT & Technology fields

Business Intelligence

Course Code: DLBCSEBI01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Business Intelligence (BI) is used to obtain information from company data that is relevant for targeted corporate management and the optimization of business activities. This course introduces and discusses techniques, procedures, and models for data provision, information generation, and analysis, as well the distribution of the information obtained. You will then be able to explain the various subject areas of data warehousing and independently select methods and techniques to meet specific requirements.

Course Outcomes

On successful completion, students will be able to

- explain the motivation, use cases, and basics of Business Intelligence.
- identify and explain techniques and methods for providing and modeling data, as well as types of data relevant to BI, differentiating between them.
- explain techniques and methods for the generation and storage of information and independently select suitable methods on the basis of concrete requirements.

Contents

1. Motivation and Conceptualization
   - 1.1 Motivation and Historical Development
   - 1.2 BI as a Framework
2. Data Provision
   - 2.1 Operative and Dispositive Systems
   - 2.2 The Data Warehouse Concept
   - 2.3 Architectural Variations
3. Data Warehouse
   - 3.1 ETL Process
   - 3.2 DWH and Data Mart
   - 3.3 ODS and Metadata
4. Modelling of Multidimensional Data Spaces

4.1 Data Modeling
4.2 OLAP Cubes
4.3 Physical Storage
4.4 Star and Snowflake Scheme
4.5 Historicization

5. Analysis Systems
5.1 Free Data Research and OLAP
5.2 Reporting Systems
5.3 Model-Based Analysis Systems
5.4 Concept-Oriented Systems

6. Distribution and Access
6.1 Information Distribution
6.2 Information Access

Literature

Compulsory Reading

Further Reading

- Grossmann, W., & Rinderle-Ma, S. (2015). Fundamentals of business intelligence. Springer.
- Sharda, R., Delen, D., & Turban, E. (2015). Business intelligence and analytics: Systems for decision support (10th ed.). Pearson.
- Sherman, R. (2014). Business intelligence guidebook: From data integration to analytics. Morgan Kaufmann.
- Vaisman, A., & Zimányi, E. (2022). Data warehouse systems: Design and implementation. Springer.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Project: Business Intelligence

Course Code: DLBCSEBI02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Using well-known methods and techniques from the field of Business Intelligence, students will work independently on a practical question in this course.At the end of the course you will be able to independently design and prototype Business Intelligence applications based on concrete requirements.

Course Outcomes

On successful completion, students will be able to

- independently design a solution to a practical problem in the field of Business Intelligence in order to then implement a prototype and document the results.
- identify and explain typical problems and challenges in the design and practical implementation of small BI solutions.

Contents

- Implementation and documentation of practical questions regarding the use of Business Intelligence applications. Typical scenarios are, for example, “Management of BI projects”, “Design of multidimensional data models” and “Prototypical implementation of small BI applications”.

Literature

Compulsory Reading

Further Reading

- Liedtka, J. (2018). Why design thinking works. Harvard Business Review, 2018(9), 72–79.
- Meinel, C., & Leifer, L. J. (2021). Design thinking research: Interrogating the doing. Springer International Publishing.
- Meinel, C., Plattner, H., & Leifer, L. (2011). Design thinking: Understand – Improve – Apply. Springer Berlin Heidelberg.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Smart Devices

Module Code: DLBINGSD_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Sheik Radiah Ravim Rivu (Smart Devices) / Tamer Abdalrahman (Project: Smart Devices)

Contributing Courses to Module

- Smart Devices (DLBINGSD01_E)
- Project: Smart Devices (DLBINGSD02_E)

Module Exam Type

Module Exam	Split Exam
	Smart Devices • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "Duales myStudium": Exam, 90 Minutes Project: Smart Devices • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "Duales myStudium": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Smart Devices

- Overview and introduction
- Smart devices
- Technological features
- Communication and networking
- User interfaces
- Ubiquitous computing

Project: Smart Devices

In-depth study of a selected topic in the field of smart devices and work on a practical task in a prototyping environment.

Learning Outcomes

Smart Devices

On successful completion, students will be able to

- recall the historical development of assistance systems towards smart devices.
- classify and define different types and examples of smart devices with regard to their properties.
- know typical features of smart devices.
- identify different communication standards with which smart devices can communicate with their environment.
- recognize different approaches with which smart devices can be controlled.
- classify smart devices as elements of ubiquitous computing.

Project: Smart Devices

On successful completion, students will be able to

- have an in-depth understanding of the technologies and standards in the context of smart devices.
- apply technologies in the context of smart devices using a simple practical example.
- design a hardware or software prototype for a selected task.
- document design and development activities in the form of a project report.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

Smart Devices

Course Code: DLBINGSD01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, students are familiarized with the properties and applications of smart devices. In doing so, the possible applications in the context of Industry 4.0 are specifically highlighted. For this purpose, current trends in microsystems technology are discussed alongside assistance functions in production, e.g. through data glasses or other wearables. In addition to the typical technological features, this course also teaches the basics of various interfaces with which a smart device interacts with its environment. These include, on the one hand, wireless system ports linked to other devices and, on the other hand, various selections for controlling the devices via a user interface. This course concludes with a classification of smart devices in the field of ubiquitous computing.

Course Outcomes

On successful completion, students will be able to

- recall the historical development of assistance systems towards smart devices.
- classify and define different types and examples of smart devices with regard to their properties.
- know typical features of smart devices.
- identify different communication standards with which smart devices can communicate with their environment.
- recognize different approaches with which smart devices can be controlled.
- classify smart devices as elements of ubiquitous computing.

Contents

1. Overview and Introduction
    - 1.1 Historical Development of Smart Devices
    - 1.2 Technological Pioneers for Smart Devices
    - 1.3 Smart Devices in the Internet of Things
2. Properties and Applications
    - 2.1 Typical Properties and Classification
    - 2.2 Example Devices
    - 2.3 Smart Devices in Microsystems Technology (MEMS)
    - 2.4 Further Fields of Application

3. Technological Features
   - 3.1 Processors
   - 3.2 Sensors
   - 3.3 Radio Interfaces

4. Communication and Networking
   - 4.1 Personal Area Networks
   - 4.2 Local Area Networks
   - 4.3 Body Area Networks
   - 4.4 Middleware for Smart Devices
   - 4.5 Open Core Interface

5. User Interfaces
   - 5.1 Touch Control
   - 5.2 Gesture Control
   - 5.3 Voice Control
   - 5.4 Multimodal Control

6. Ubiquitous Computing
   - 6.1 Aims and Basic Properties of Ubiquitous Systems
   - 6.2 Examples for Ubiquitous Systems
   - 6.3 Context Sensitivity
   - 6.4 Autonomy
   - 6.5 Smart Device Management

Literature
Compulsory Reading
Further Reading ▪ Fortino, G., & Trunfio, P. (2014). Internet of Things Based on Smart Objects: Technology, Middleware and Applications. Springer International Publishing. ▪ López, T. S. et al. (2011). Taxonomy, Technology and Applications of Smart Objects. Information Systems Frontiers, 13(2), 281–300. ▪ McTear, M., Callejas, Z., & Griol, D. (2016). The Conversational Interface: Talking to Smart Devices. Springer International Publishing. ▪ Nihtianov, S., & Luque, A. (2014). Smart Sensors and MEMS: Intelligent Devices and Microsystems for Industrial Applications. Woodhead. ▪ Poslad, S. (2009). Ubiquitous Computing: Smart Devices, Environments and Interactions (2nd ed.). Wiley. - Sendler, U. (Ed.) (2018). The Internet of Things – Industrie 4.0 Unleashed. Springer. ▪ Vinoy, K. J. et al. (Eds.) (2014). Micro and Smart Devices and Systems. Springer India.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Project: Smart Devices

Course Code: DLBINGSD02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, students select one assignment from the provided topic catalogue in consultation with the tutor. They work on the task with the help of a prototyping environment that fits the subject matter of the assignment. The environments can be hardware (e.g. prototyping boards) or software (e.g. technology-specific development environments). To complete the task, students apply concepts, methods and tools taught in the Smart Devices I course. They document their results in a project report.

Course Outcomes

On successful completion, students will be able to

- have an in-depth understanding of the technologies and standards in the context of smart devices.
- apply technologies in the context of smart devices using a simple practical example.
- design a hardware or software prototype for a selected task.
- document design and development activities in the form of a project report.

Contents

- A catalogue with currently available assignments is provided on the online learning platform. It provides the content basis of the module and can be supplemented or updated by the tutor.

Literature

Compulsory Reading

Further Reading

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Tutorial Support ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	**Exam Preparation** ☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Tutorial Support ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	**Exam Preparation** ☑ Guideline

Smart Factory

Module Code: DLBDSESF

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Sahar Qaadan (Smart Factory) / Dr. Sahar Qaadan (Project: Smart Factory)

Contributing Courses to Module

- Smart Factory (DLBDSESF01)
- Project: Smart Factory (DLBDSESF02)

Module Exam Type

Module Exam	Split Exam
	Smart Factory • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Project: Smart Factory • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Smart Factory

- Motivation and Definition of Terms
- Development of Automation
- Technological Basics and Standards
- Basic concepts of a Smart Factory
- Reference Architectures
- Smart Factory Engineering
- Safety and Security

Project: Smart Factory

A catalogue with the currently provided tasks is provided on the online platform of the module. It provides the content basis of the module and can be supplemented or updated by the seminar leader.

Learning Outcomes

Smart Factory

On successful completion, students will be able to

- understand the term Smart Factory in the context of Industry 4.0.
- be able to trace the development of automation to a fully autonomous, non-centrally organized production plant.
- understand the basic technologies and standards used to design and operate a Smart Factory.
- understand the essential concepts of a Smart Factory.
- identify and differentiate between the individual elements of a Smart Factory using different reference architectures.
- understand the special engineering challenges in the Smart Energy context.
- understand the special safety risks of digitized and networked production plants and assign concrete recommendations for action.

Project: Smart Factory

On successful completion, students will be able to

- have a deeper understanding of the technologies and standards in the context of Smart Factory.
- apply technologies in the context of Smart Factory to a simple practical example.
- design a hardware or software prototype for a selected task.
- document, design, and develop activities in the form of a project report.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programmes in the IT & Technology field

Smart Factory

Course Code: DLBDSESF01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, students will gain a deeper insight into the networking and digitization of production facilities by examining a Smart Factory. For this purpose, they will be familiarized with the basic goals of a Smart Factory in the context of the research complex Industry 4.0. After a brief introduction to the history of automation, students will learn the technical basics and standards required to design and operate a Smart Factory. Building on this, they will learn how these individual technologies are used to implement the central concepts of a Smart Factory. In order to understand which components a Smart Factory consists of, different reference architectures are presented and compared. The course concludes with the special engineering challenges of an autonomously acting and decentralized production plant. Above all, this includes IT security, which is particularly relevant due to the digital networking of production facilities and products.

Course Outcomes

On successful completion, students will be able to

- understand the term Smart Factory in the context of Industry 4.0.
- be able to trace the development of automation to a fully autonomous, non-centrally organized production plant.
- understand the basic technologies and standards used to design and operate a Smart Factory.
- understand the essential concepts of a Smart Factory.
- identify and differentiate between the individual elements of a Smart Factory using different reference architectures.
- understand the special engineering challenges in the Smart Energy context.
- understand the special safety risks of digitized and networked production plants and assign concrete recommendations for action.

Contents

1. Motivation and Definition of Terms
    - 1.1 Goals of Smart Factory
    - 1.2 Internet of Things
    - 1.3 Cyber-Physical Systems
    - 1.4 Cyber-Physical Production Systems
    - 1.5 Smart Factory as a Cyber-Physical (Production) System

2. Development of Automation
   - 2.1 Automation Pyramid
   - 2.2 Networked, Decentralized Organization of Production
   - 2.3 Future Challenges

3. Technological Basics and Standards
   - 3.1 Identification of Physical Objects
   - 3.2 Formal Description Languages and Ontologies
   - 3.3 Digital Object Memory
   - 3.4 Physical Situation Recognition
   - 3.5 (Partially) Autonomous Action and Cooperation
   - 3.6 Human-Machine Interaction
   - 3.7 Machine to Machine Communication

4. Basic Concepts of a Smart Factory
   - 4.1 Order-Controlled Production
   - 4.2 Bundling of Machine and Production Data
   - 4.3 Supporting People in Production
   - 4.4 Intelligent Products and Resources
   - 4.5 Smart Services

5. Reference Architectures
   - 5.1 Purpose and Properties of Reference Architectures
   - 5.2 Overview of Standardization Initiatives
   - 5.3 CyProS Reference Architecture
   - 5.4 RAMI 4.0 (DIN SPEC 91345)

6. Smart Factory Engineering
   - 6.1 Classification of Different Engineering Tools
   - 6.2 Virtual Engineering
   - 6.3 User-Centered Design
   - 6.4 Requirements Engineering
   - 6.5 Modelling
   - 6.6 Integration of Classic and Smart Components

Literature
Compulsory Reading
Further Reading ▪ Butun, I. (2020). Industrial IoT: Challenges, design principles, applications, and security. Springer. ▪ Drossel, W. G., Ihlenfeldt, S., Lanzger, T., & Dumitrescu, R. (2019). Cyber-physical systems. In R. Neugebauer (Ed.), Digital transformation (pp. 189—213). Springer. ▪ Durakbasa, N. M., & Gençyılmaz, M. G. (Eds.). (2021). Digital conversion on the way to Industry 4.0. Springer. ▪ Ustundag, A., & Cevikcan, E. (2018). Industry 4.0: Managing the digital transformation. Springer.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Project: Smart Factory

Course Code: DLBDSESF02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, students select a concrete task from the catalog of topics provided in consultation with the seminar leader. They will work on the task in a prototyping environment suited to the task, which can be either a hardware (e.g., prototyping boards) or software (e.g., technology-specific development environments) environment. To complete the task, students apply the concepts, methods, and tools taught in the Smart Factory I course. They document their results with a project report.

Course Outcomes

On successful completion, students will be able to

- have a deeper understanding of the technologies and standards in the context of Smart Factory.
- apply technologies in the context of Smart Factory to a simple practical example.
- design a hardware or software prototype for a selected task.
- document, design, and develop activities in the form of a project report.

Contents

- A catalogue with the currently provided tasks is provided on the online platform of the module. It provides the content basis of the module and can be supplemented or updated by the seminar leader.

Literature
Compulsory Reading
Further Reading ▪ Arey, D., Le, C. H. & Gao, J. (2021). Lean industry 4.0: a digital value stream approach to process improvement. Procedia Manufacturing, 54, 19–24. ▪ Hartmann, L., Meudt, T., Seifermann, S. & Metternich, J. (2018). Value stream method 4.0: holistic method to analyse and design value streams in the digital age. Procedia CIRP, 78, 249–254. ▪ Luscinski, S. & Ivanov, V. (2020). A Simulation Study of Industry 4.0 Factories based on the Ontology on Flexibility with using FlexSim Software. Management and Production Engineering Review (volume 11, number 3), S. 74–83. ▪ Meroni, G., Baresi, L., Montali, M. & Plebani, P. (2017). Multi-party business process compliance monitoring through IoT-enabled artifacts. Information Systems, 73, 61-78. ▪ OMG (2014). Business Process Model and Notation (BPMN). Version 2.0.2

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Tutorial Support ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	**Exam Preparation** ☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Tutorial Support ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	**Exam Preparation** ☑ Guideline

Smart Mobility

Module Code: DLBINGSM_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Dorian Mora (Smart Mobility) / Prof. Dr. Dorian Mora (Project: Smart Mobility)

Contributing Courses to Module

- Smart Mobility (DLBINGSM01_E)
- Project: Smart Mobility (DLBINGSM02_E)

Module Exam Type

Module Exam	Split Exam
	Smart Mobility • Study Format "Distance Learning": Exam, 90 Minutes Project: Smart Mobility • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Smart Mobility

- Introduction and Definitions
- Overview over traditional mobility infrastructure approaches
- Alternative approaches to mobility
- Services for smart mobility
- Overview over relevant technologies and standards
- Car2X Communication
- Examples and use-cases

Project: Smart Mobility

In-depth analysis of a specific topic in the context of Smart Mobility in form of a prototype report.

Learning Outcomes

Smart Mobility

On successful completion, students will be able to

- remember several types of mobility.
- understand distinct reasons for designing intelligent mobility systems.
- analyze diverse types of mobility infrastructure regarding their properties and access requirements.
- understand various alternative mobility approaches.
- remember a range of services that relevant for Smart Mobility.
- understand the relevant technologies and standards for connecting infrastructure elements and services.
- understand use cases for Car2X communication and the relevant standards and technologies.
- remember example projects in the context of Smart Mobility.

Project: Smart Mobility

On successful completion, students will be able to

- have an in-depth understanding of the technologies and standards in the context of Smart Mobility.
- apply technologies in the context of Smart Mobility using a simple practical example.
- design a hardware or software prototype for a selected task.
- document design choices and development tasks in the form of a project report.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

Smart Mobility

Course Code: DLBINGSM01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course gives an introduction and overview into the future of mobility. Starting from an understanding of traditional and current mobility infrastructure, alternative approaches are introduced. The course discusses a range of services that are typical for smart mobility solutions. The course includes a detailed discussion on technologies and standards relevant for smart mobility, in particular in Car2X communication. A range of projects and examples are discussed to illustrate the application of smart mobility approaches in a real-life context.

Course Outcomes

On successful completion, students will be able to

- remember several types of mobility.
- understand distinct reasons for designing intelligent mobility systems.
- analyze diverse types of mobility infrastructure regarding their properties and access requirements.
- understand various alternative mobility approaches.
- remember a range of services that relevant for Smart Mobility.
- understand the relevant technologies and standards for connecting infrastructure elements and services.
- understand use cases for Car2X communication and the relevant standards and technologies.
- remember example projects in the context of Smart Mobility.

Contents

1. Introduction and Definitions
    - 1.1 Types of Mobility
    - 1.2 Smart Mobility and Smart City
    - 1.3 Efficient use of energy
    - 1.4 Emissions
    - 1.5 Security
    - 1.6 Comfort
    - 1.7 Cost Effectiveness
2. Overview over traditional mobility infrastructure approaches

- 2.1 Properties and Access Requirements
- 2.2 Infrastructure Planning
- 2.3 Disadvantages of Isolated Infrastructures

3. Alternative approaches to mobility
   - 3.1 Park and Ride
   - 3.2 Car-Sharing
   - 3.3 Rent A Bike
   - 3.4 Carpooling

4. Services for smart mobility
   - 4.1 Authorization
   - 4.2 Payment
   - 4.3 Booking
   - 4.4 Navigation
   - 4.5 Security
   - 4.6 Hybrid Services

5. Overview over relevant technologies and standards
   - 5.1 Mobile Devices
   - 5.2 Mobile Networks and Wireless LAN
   - 5.3 NFC and RFID
   - 5.4 Outdoor and Indoor Localization
   - 5.5 Technologies for Traffic Monitoring

6. Car2X Communication
   - 6.1 Use Cases
   - 6.2 Elements of a Car2X System
   - 6.3 Technologies and Standards
   - 6.4 Sample Implementations

7. Examples and use-cases
   - 7.1 Octopus (Hong Kong)
   - 7.2 Amsterdam Practical Trial
   - 7.3 Mobincity

Literature
Compulsory Reading
Further Reading ▪ Fluegge, B. (2017): Smart Mobility – Connecting Everyone: Trends, Concepts and Best Practices Paperback. Springer/Vierweg, Wiesbaden. ▪ Handke, V./Jonuschat, H. (2013): Flexible Ridesharing. New Opportunities and Service Concepts for Sustainable Mobility. Springer, Berlin/Heidelberg. ▪ Inderwildi, O./King, D. (Eds.) (2012): Energy, Transport, & the Environment. Addressing the Sustainable Mobility Paradigm. Springer, London. ▪ Nathanail, E./Karakikes, I. (2018): Data Analytics: Paving the Way to Sustainable Urban Mobility: Proceedings of 4th Conference on Sustainable Urban Mobility (CSUM2018). Springer, London. ▪ Papa, R./Fistola, R./Gargiulo, C. (2018): Smart Planning: Sustainability and Mobility in the Age of Change (Green Energy and Technology). Springer, London. ▪ Planing, P. et al (2020): Innovations for Metropolitan Areas: Intelligent Solutions for Mobility, Logistics and Infrastructure designed for Citizens. Springer, London. ▪ Sashinskaya, M. (2015): Smart Cities in Europe. Open Data in a Smart Mobility Context. Createspace Independent Publishing Platform.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
	☑ Slides	

Project: Smart Mobility

Course Code: DLBINGSM02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In the course Smart Mobility II, students are asked to choose an assignment provided by the course tutor to apply the concepts and methods covered in Smart Mobility I in a specific use case or application area. The students will develop a prototype focused on a specific topic related to smart mobility. The prototype can be developed either as a hardware setup or a software solution. The students document their results in a project report.

Course Outcomes

On successful completion, students will be able to

- have an in-depth understanding of the technologies and standards in the context of Smart Mobility.
- apply technologies in the context of Smart Mobility using a simple practical example.
- design a hardware or software prototype for a selected task.
- document design choices and development tasks in the form of a project report.

Contents

- A catalogue with currently available assignments is provided on the online learning platform. It provides the content basis of the module and can be supplemented or updated by the tutor.

Literature

Compulsory Reading

Further Reading

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint	☑ Slides	☑ Guideline

Smart Services

Module Code: DLBINGSS_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Holger Klus (Smart Services) / Prof. Dr. Holger Klus (Project: Smart Services)

Contributing Courses to Module

- Smart Services (DLBINGSS01_E)
- Project: Smart Services (DLBINGSS02_E)

Module Exam Type

Module Exam	Split Exam
	Smart Services • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Project: Smart Services • Study Format "myStudies": Written Assessment: Project Report • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Smart Services

- Digitization and disruption
- Potential of Smart Services
- Development and specification of Smart Services
- Service architectures
- Integration platforms
- Technologies for Smart Services
- Quality and operation of Smart Services

Project: Smart Services

Analysis of a selected topic of Smart Services and design of a self-chosen assignment in a prototyping environment.

Learning Outcomes

Smart Services

On successful completion, students will be able to

- recognize the relevance of Smart Services in the context of digitization in general and Industry 4.0 in particular.
- identify special features of digital business models and demonstrate them using the example of digital intermediaries.
- apply methods to uncover digitization potentials and use the Business Model Canvas to classify them in a business model.
- know and use models for the multi-perspective specification of services.
- know selected architectures for the design and integration of services.
- distinguish different technologies that are required for the development of services.
- define the quality of services by means of Service Level Agreements.

Project: Smart Services

On successful completion, students will be able to

- have an in-depth understanding of the technologies and standards in the context of Smart Services.
- apply technologies in the context of smart services using a simple practical example.
- design a hardware or software prototype for a selected technical task.
- document design and development activities in the form of a project report.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Smart Services

Course Code: DLBINGSS01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, students study concepts and methods for the development of Smart Services. For this purpose, an introduction of the term in the context of digitization and Industry 4.0 will be given. Based on this, this course shows how innovative services can have a disruptive effect on existing business models or even markets using the example of digital intermediaries. Subsequently, students will be taught selected methods and techniques with which digitization potentials can be recognized and modelled. In addition, selected architectures and platforms for the integration of services are presented. Finally, relevant technologies for the implementation of smart services are taught and it is briefly described how the quality of services can be agreed upon.

Course Outcomes

On successful completion, students will be able to

- recognize the relevance of Smart Services in the context of digitization in general and Industry 4.0 in particular.
- identify special features of digital business models and demonstrate them using the example of digital intermediaries.
- apply methods to uncover digitization potentials and use the Business Model Canvas to classify them in a business model.
- know and use models for the multi-perspective specification of services.
- know selected architectures for the design and integration of services.
- distinguish different technologies that are required for the development of services.
- define the quality of services by means of Service Level Agreements.

Contents

1. Introduction and Motivation
   - 1.1 Digitization and Cyber-Physical Production Systems
   - 1.2 Smart Services in Industry 4.0
   - 1.3 Examples of Smart Services
2. Digitization and Disruption
   - 2.1 Definition: Digital Business Models
   - 2.2 Strategies for Change and Innovation

- 2.3 Digital Intermediaries
- 2.4 Examples of Disruptive Business Models

3. Recognizing Potential for Smart Services
   - 3.1 Business Model Canvas
   - 3.2 Personas
   - 3.3 Customer Journeys
   - 3.4 Domain-Driven Design

4. Development and Specification of Smart Services
   - 4.1 Modelling of the System Context
   - 4.2 Modelling of Business Processes
   - 4.3 Modelling of Technical Interfaces
   - 4.4 Tools for API Specification

5. Service Architectures
   - 5.1 Infrastructure/Platform/Software-as-a-Service
   - 5.2 Everything-as-a-Service
   - 5.3 Service-oriented Architectures
   - 5.4 Micro Services

6. Integration Platforms
   - 6.1 Features and Purpose of Integration Platforms
   - 6.2 Enterprise Integration Patterns
   - 6.3 External Integration with Zapier, IFTTT & Others

7. Technologies for Smart Services
   - 7.1 Formats for Data Exchange
   - 7.2 Internet Communication Protocols
   - 7.3 Semantic Descriptions
   - 7.4 Complex Event Processing
   - 7.5 Security

8. Quality and Operation of Smart Services
   - 8.1 Quality Characteristics and Maturity of APIs
   - 8.2 Service Level Agreements
   - 8.3 Service Level Management

Literature
Compulsory Reading
Further Reading ▪ Chignell, M. et al. (Hrsg.) (2010): The Smart Internet. Current Research and Future Applications. Springer. ▪ Evans, E. (2003): Domain-Driven Design. Tackling Complexity in the Heart of Software. Addison-Wesley, Upper Saddle River. ▪ Hohpe, G./Woolf, B./Brown, K. (2012): Enterprise Integration Patterns. Designing, Building, and Deploying Messaging Solutions. 16th edition, Addison-Wesley. ▪ Nielsen, L. (2013): Personas – User Focused Design. Springer. ▪ Osterwalder, A/Pigneur, Y. (2010): Business Model Generation: A Handbook for Visionaries, Game Changers, John Wiley & Sons Inc.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Project: Smart Services

Course Code: DLBINGSS02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, the students select a concrete technical task from the provided topic catalogue in consultation with the seminar leader. They work on the task with the help of a prototyping environment that is suitable for the subject of the task. The environments can be hardware (e.g. prototyping boards) or software (e.g. technology-specific development environments). To complete the task, students apply the concepts, methods and tools taught in the Smart Services I course. They document their results in a project report.

Course Outcomes

On successful completion, students will be able to

- have an in-depth understanding of the technologies and standards in the context of Smart Services.
- apply technologies in the context of smart services using a simple practical example.
- design a hardware or software prototype for a selected technical task.
- document design and development activities in the form of a project report.

Contents

- A catalogue with currently available assignments is provided on the online learning platform. It provides the content basis of the module and can be supplemented or updated by the tutor.

Literature

Compulsory Reading

Further Reading

- Lee, K.-H., & Kim, D. (2019). A peer-to-peer (P2P) platform business model: The case of Airbnb. Service Business: An International Journal, 13(4), 647-669.
- Maleshkova, M., Kühl, N., & Jussen, P. (2020). Smart service management: Design guidelines and best practices. Springer.
- Osterwalder, A., & Pigneur, Y. (2010). Business model generation: A handbook for visionaries, game changers, and challengers [Electronic resource]. Wiley.

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

IT Security Consulting

Module Code: DLBCSEEISC_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum		BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Dr. Rachel John Robinson (Technical and Operational IT Security Concepts) / Jetzabel Maritza Serna-Olvera (Project: Configuration and Application of SIEM Systems)

Contributing Courses to Module

- Technical and Operational IT Security Concepts (DLBCSEEISC01_E)
- Project: Configuration and Application of SIEM Systems (DLBCSEEISC02_E)

Module Exam Type

Module Exam	Split Exam
	Technical and Operational IT Security Concepts • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Project: Configuration and Application of SIEM Systems • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Technical and Operational IT Security Concepts

- Network analysis and evaluation
- Protection Profiles
- Intrusion Detection Systems
- Network Monitoring
- Security Information and Event Management (SIEM)
- IT-Security evaluation and assessment

Project: Configuration and Application of SIEM Systems

This course will give students hands-on experience in the challenging task of implementing a Security Incident Event Management (SIEM) Tool into an Enterprise IT-Environment. Students will need to consider practical aspects such as different data sources, data fusion and big data analytics methods and processing, as well as constraints such as data availability and multiple data formats.

Learning Outcomes

Technical and Operational IT Security Concepts

On successful completion, students will be able to

- analyze and evaluate IT systems and networks and detect vulnerabilities.
- develop enterprise specific protection profiles.
- design and implement tools for sensor based network monitoring, intrusion detection and response.
- use Big Data fusion mechanisms, evaluate and assess the IT-system network security status and decide and initiate incident response measures.
- evaluate the security status of IT systems and networks and provide guidance for improvement.

Project: Configuration and Application of SIEM Systems

On successful completion, students will be able to

- understand the challenges of integrating a SIEM into an existing enterprise IT infrastructure.
- evaluate the constraints the implementation project imposes on the execution of a SIEM.
- identify the necessary intrusion detection and monitoring components required for reliable execution of the SIEM tool.
- analyze requirements regarding data acquisition, data fusion, analysis, and processing.
- identify deviation from normal behavior in IT systems / networks.
- initiate further deep investigation of malware samples and apply relevant response strategies - including automated responses.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the fields of IT & Technology

Technical and Operational IT Security Concepts

Course Code: DLBCSEEISC01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

IT-Systems and Networks containing and processing highly sensitive information and data as well as IT-Infrastructure in support of business-critical processes or national critical infrastructure require higher security mechanism regarding confidentiality, integrity and availability. Based on specific “Protection Profiles” high sophisticated tools, mechanisms and procedures need to be designed, implemented, configurated and operated.With this course the student will be able to evaluate given IT-Infrastructure, support the security-design of new IT-Systems and Networks by developing specific Protection Profiles, evaluate which technical and operational security measures and application are required and how these are integrated, configured and operated.

Course Outcomes

On successful completion, students will be able to

- analyze and evaluate IT systems and networks and detect vulnerabilities.
- develop enterprise specific protection profiles.
- design and implement tools for sensor based network monitoring, intrusion detection and response.
- use Big Data fusion mechanisms, evaluate and assess the IT-system network security status and decide and initiate incident response measures.
- evaluate the security status of IT systems and networks and provide guidance for improvement.

Contents

1. Network Analysis and Evaluation
    - 1.1 Layer Specific Threats and Vulnerabilities
    - 1.2 DATA Flow, Interdependencies and Interrelationships
    - 1.3 Vulnerability Scanning and Detection
    - 1.4 Supporting Tools and Techniques
2. Protection Profiles
    - 2.1 Reference Architecture Technology and Networking
    - 2.2 Risk Assessment, Residual Risk and Risk Management
    - 2.3 Security Requirements and Safeguards
    - 2.4 Security Evaluation of IT-Security Products

2.5 Accreditation of IT-Systems and Networks

3. Intrusion Detection Systems
   - 3.1 Detection Strategy
   - 3.2 Data Sources, Sensors
   - 3.3 Analytics
   - 3.4 Indicators of Compromise

4. Network Monitoring
   - 4.1 Threat Protection Systems
   - 4.2 Wireless Sensor Networks Technology
   - 4.3 Threat Information Sharing

5. Security Information and Event Management (SIEM)
   - 5.1 Technical and Operational DATA Sources
   - 5.2 DATA Fusion
   - 5.3 Network Norm Behavior
   - 5.4 Big Data Analysis – Transferring Technical Data for Operational Information
   - 5.5 Security Situation Picture, Situational Awareness
   - 5.6 Incident Response Strategies and Automated Responses

6. IT-Security Evaluation and Assessment
   - 6.1 IT-Security Metrics
   - 6.2 IT-Security Assessment

Literature

Compulsory Reading

Further Reading

- Federal Office for Information Security (BSI) (2018): IT-Grundschutz Profiles - Structural Description - COMMUNITY DRAFT.
- Hayden, L. (2010): IT Security Metrics: A Practical Framework for Measuring Security & Protecting Data. McGraw-Hill Education.
- McNab, C. (2016): Network Security Assessment: Know Your Network. 3. Auflage, O'Reilly UK Ltd.
- Miller, D. R. et al. (2011): Security Information and Event Management (SIEM) Implementation. McGraw-Hill Education.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Project: Configuration and Application of SIEM Systems

Course Code: DLBCSEEISC02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBCSEEISC01_E or DLBCSEEISC01_D

Course Description

This course will give students hands-on experience in the challenging task of implementing a Security Incident Event Management (SIEM) Tool into an Enterprise IT-Environment. Students will need to consider practical aspects such as different data sources, data fusion and big data analytics methods and processing, as well as constraints such as data availability and multiple data formats. Furthermore, students will face the challenge to transfer technical data into operational Information to initiate valid responses. By the end of this course, students will have obtained well-founded knowledge of the integration of SIEM into enterprise IT infrastructure, applications and services.

Course Outcomes

On successful completion, students will be able to

- understand the challenges of integrating a SIEM into an existing enterprise IT infrastructure.
- evaluate the constraints the implementation project imposes on the execution of a SIEM.
- identify the necessary intrusion detection and monitoring components required for reliable execution of the SIEM tool.
- analyze requirements regarding data acquisition, data fusion, analysis, and processing.
- identify deviation from normal behavior in IT systems / networks.
- initiate further deep investigation of malware samples and apply relevant response strategies - including automated responses.

Contents

- This course focuses on practical aspects of the implementation of a SIEM into an enterprise IT infrastructure environment. Students start with a chosen use case and SIEM and then evaluate requirements which need to be fulfilled so that the SIEM can be used as part of an enterprise IT system / network. Students need to evaluate requirements for sensors, network monitoring, intrusion detection, data fusion, big data analytics, and translating technical data into operational information.
- Based on the available information, valid responses – including automated responses - will be identified and processed.
- All relevant artifacts and considerations are documented by the students in a project report.

Literature
Compulsory Reading
Further Reading ▪ Al-Sakib, K. P. (2016): The State of the Art in Intrusion Prevention and Detection. Routledge, Abingdon. ▪ Miller, D. et al (2011): Security Information and Event Management (SIEM) Implementation. McGraw-Hill Education, New York City, NY. ▪ Mitchell, H. B. (2007): Multi-Sensor Data Fusion: An Introduction. Springer Verlag, Berlin.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Business Consulting

Module Code: BWCN_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Johannes Ritz (Business Consulting I) / Johannes Ritz (Business Consulting II)

Contributing Courses to Module

- Business Consulting I (BWCN01_E)
- Business Consulting II (BWCN02_E)

Module Exam Type

Module Exam	Split Exam
	Business Consulting I • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Business Consulting II • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents

Business Consulting I

- Introduction to Business Consulting
- Forms and Functions of Business Consulting
- The Market for Business Consulting
- History, pioneers and concepts
- Consulting fields

Business Consulting II

- Business Modell of Business Consulting
- Forms and Functions of Business Consulting
- Marketing of Consulting Services
- Consultant Liability, Contract Drafting and Professional Law
- The Consulting Project

Learning Outcomes

Business Consulting I

On successful completion, students will be able to

- understand the various definitions of business consulting.
- explain the tasks and approaches of business consultants.
- name the characteristics of business consultancies.
- explain business consulting as a highly specialized service.
- identify the specifics of the consultant-client relationship.

Business Consulting II

On successful completion, students will be able to

- explain the special framework conditions of consulting companies.
- identify the approaches in marketing for consulting services.
- explain the strategic and operational direction of consulting companies.
- understand the challenges of human resource management in consulting companies.
- explain the operational phases of the consulting process.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Business Administration & Management	All Bachelor Programs in the Business & Management field

Business Consulting I

Course Code: BWCN01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Business consulting is a professional service whose overall economic significance is increasing. Business consultants provide professional consulting services for client companies. This requires the ability to analyze and evaluate specific corporate and market situations with the help of modern management concepts. Based on their analyses, business consultants make recommendations for optimizing corporate strategies, structures and processes and - if desired - accompany them during implementation and realization. In order to fulfill successfully the various functions and tasks of business consulting, business consultants require a differentiated profile of technical-methodical and personal-social competencies. The center of professional competencies is composed of basic and specialized knowledge in consulting and business administration. They include analytical skills for understanding corporate and market situations as well as the ability to plan, implement and control consulting projects. The development of personal and social competences aims at the client-centeredness of the students in the sense of the ability to adapt to the individual consulting needs of clients.

Course Outcomes

On successful completion, students will be able to

- understand the various definitions of business consulting.
- explain the tasks and approaches of business consultants.
- name the characteristics of business consultancies.
- explain business consulting as a highly specialized service.
- identify the specifics of the consultant-client relationship.

Contents

1. Introduction to Business Consulting
   - 1.1 Business Consulting – Management Consulting
   - 1.2 Business Consulting as a Subject of Science
2. History, Pioneers, and Concepts
   - 2.1 History of Business Consulting
   - 2.2 Business Consulting Concepts
3. Forms and Functions of Business Consulting

3.1 The External Consulting Process
3.2 Inhouse Consulting

4. The Market for Business Consulting
   4.1 Data, Structures, and Trends
   4.2 Consulting Companies in Germany

5. Consulting Fields
   5.1 Strategy Consulting
   5.2 Organization and Transformation Consulting
   5.3 IT Consulting

Literature

Compulsory Reading

Further Reading

- Cerruti, C., Tavoletti, E., & Grieco, C. (2019). Management consulting: a review of fifty years of scholarly research. Management Research Review, 42(8), 902-925.
- Curuksu, J.D. (2018). Data Driven. An Introduction to Management Consulting in the 21st Century. Cham, Switzerland: Springer.
- da Costa, R. L., et al. (2013). The „Fashionable Knowledge“ of Management Consulting. Journal of Management and Sustainability, 3(3), 180-188.
- FEACO. (2019). Survey of the European Management Consultancy 2018/2019. Retrieved from http://www.feaco.org/sites/default/files/sitepagefiles/Feaco.Survey%202018-2019.pdf
- Kubr, M. (2002). Management Consulting: A Guide to the Profession. (4th ed). Genf: International Labour Office.
- Nippa, M., & Petzold, K. (2002). Economic functions of management consulting firms – an integrative theoretical framework. In Academy Of Management Proceedings & Membership Directory, B1–B6.

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Practice Exam
- ☑ Online Tests

Business Consulting II

Course Code: BWCN02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Business consultants offer professional consulting services for client companies. The object of business consulting is therefore the acquisition, planning and implementation of business consulting projects. The content of these consulting projects is diverse and, depending on the task, can include aspects of strategic corporate management, challenges in the area of financing and cost reduction, the introduction of new technologies, working methods and systems, internal communication, restructuring, mergers/acquisitions or outsourcing of companies or individual company divisions. Consulting projects and consulting processes are characterized by recurring elements, the understanding and application of which significantly influence the success of a consulting service. The competence and quality of contract acquisition and project management is determined by the management of the consulting firm itself. Depending on the consulting philosophy, consulting concept, consulting organization and service marketing, success or failure is reached in consultant-client relationships. Participation in the course requires successful completion of the Business Consulting I course.

Course Outcomes

On successful completion, students will be able to

- explain the special framework conditions of consulting companies.
- identify the approaches in marketing for consulting services.
- explain the strategic and operational direction of consulting companies.
- understand the challenges of human resource management in consulting companies.
- explain the operational phases of the consulting process.

Contents

1. The Business Model of Business Consulting
   - 1.1 The Business Consultancy as a Professional Service Firm
   - 1.2 The Value Creation Model of Business Consulting
   - 1.3 The Market Environment of the Consulting Company
2. The Management of the Consultancy Company
   - 2.1 Fields of Action and Decision-Making for the Management of Business Consulting Companies
   - 2.2 Normative and Strategic Fields of Action and Decision-Making

2.3 Personnel and HR Management in the Consulting Company

3. Marketing of Consulting Services
   - 3.1 Special Features of Service Marketing
   - 3.2 Strategic Marketing of Consulting Companies
   - 3.3 Relationship Marketing of Consulting Companies

4. Consultant Liability, Contract Drafting and Professional Law
   - 4.1 Consultant Liability
   - 4.2 Contract Drafting
   - 4.3 Legal Issues of Professional Practice

5. The Consulting Project
   - 5.1 Requirements
   - 5.2 Settings and Techniques
   - 5.3 Consulting Phase

Literature

Compulsory Reading

Further Reading

- Block, P. (2011). Flawless consulting: A guide to getting your expertise used (3rd ed.). Pfeiffer.
- Chereau, P., & Meschi, P.-X. (2018). Strategic consulting: Tools and methods for successful strategy missions. Palgrave Macmillan.
- Kaiser, S., & Others. (2015). Human Resource Management in Professional Service Firms: Learning from a framework for research and practice. Zeitschrift Für Personalforschung, 29(2), 77-101.
- Kubr, M. (2002). Management consulting: A guide to the profession (4th ed.). International Labour Office.
- Skjølsvik, T., Pemer, F., & Løwendahl, B. (2017). Strategic management of professional service firms: Reviewing ABS journals and identifying key research themes. Journal Of Professions & Organization, 4(2), 203-239.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods

Tutorial Support	Learning Material	Exam Preparation
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Augmented, Mixed and Virtual Reality

Module Code: DLBMIAMVR_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Janki Dodiya (Augmented, Mixed and Virtual Reality) / Prof. Dr. Armin Grasnick (Project: X-Reality)

Contributing Courses to Module

- Augmented, Mixed and Virtual Reality (DLBMIAMVR01_E)
- Project: X-Reality (DLBMIAMVR02_E)

Module Exam Type

Module Exam	Split Exam
	Augmented, Mixed and Virtual Reality • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes • Study Format "Duales myStudium": Exam, 90 Minutes Project: X-Reality • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "Duales myStudium": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report

Weight of Module
see curriculum

Module Contents

Augmented, Mixed and Virtual Reality

- Definition and Differentiation of Terms
- Fields of Application and Examples
- Aspects of Human Perception
- Augmented and Virtual Reality Output Devices
- Input Devices
- Interaction in Virtual and Augmented Realities
- Aspects of XR Application Development
- Future of XR Technologies

Project: X-Reality

Development of AR-/VR-Application; Design, Implementation and Documentation; Challenges and Problems

Learning Outcomes

Augmented, Mixed and Virtual Reality

On successful completion, students will be able to

- name the characteristics and differences of augmented, mixed, and virtual reality techniques.
- describe the importance of sensual perception in AR and VR.
- explain the basic technical features of AR and VR systems.
- explain the different interaction possibilities in AR and VR applications.
- perform selected development processes for AR and VR applications.

Project: X-Reality

On successful completion, students will be able to

- implement a small AR/VR application by themselves.
- experiment with the concept of AR/VR applications.
- discuss challenges and issues in AR/VR software development.
- document the concept and implementation of independently developed AR/VR applications and accumulated experience in a project report.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

Augmented, Mixed and Virtual Reality

Course Code: DLBMIAMVR01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Augmented, mixed and virtual reality (AR, MR and VR) technologies are becoming increasingly important in a wide range of application areas. In this context, novel hardware devices and forms of interaction are used. In addition to the technical foundations, this course covers aspects of human perception and approaches for developing AR/VR applications. To give the students a knowledge of the field, the terms augmented, mixed, and virtual reality will be defined and differentiated and examples of their use will be demonstrated. In order to simulate the existence of a virtual world or virtual objects to users, aspects of human perception have to be used. Based on the fundamentals of human information processing, the course highlights the phenomena, problems, and solutions that have to be considered in AR and VR applications. AR and VR systems can be implemented in different ways. This course addresses different output forms, tracking methods and interaction possibilities. In addition, other techniques that are specifically relevant in the AR field will be represented. Software development in the AR and VR field may require the application of special processes. This course teaches selected approaches that are helpful in designing, prototyping, and testing AR and VR applications. The course concludes with a view at the future applications and the research potential of augmented, mixed, and virtual reality.

Course Outcomes

On successful completion, students will be able to

- name the characteristics and differences of augmented, mixed, and virtual reality techniques.
- describe the importance of sensual perception in AR and VR.
- explain the basic technical features of AR and VR systems.
- explain the different interaction possibilities in AR and VR applications.
- perform selected development processes for AR and VR applications.

Contents

1. Introduction to Augmented, Mixed and Virtual Reality
   - 1.1 Definition and Differentiation of Terms
   - 1.2 Fields of Application and Examples
2. Aspects of Human Perception
   - 2.1 Human Information Processing
   - 2.2 Visual Perception

- 2.3 Multisensory Perception
- 2.4 Phenomena, Problems and Solutions

3. Virtual Reality Output Devices
   - 3.1 Reality System: Input, Output and User
   - 3.2 Visual Displays and its Characteristics
   - 3.3 Multisensory Display Technology

4. Augmented Reality Output Devices
   - 4.1 Tracking
   - 4.2 Video See-Through vs. Optical See-Through vs. Projection
   - 4.3 General Differences between Devices

5. Input Devices
   - 5.1 Hand Input Devices
   - 5.2 Non-Hand Input Devices

6. Interaction in Virtual and Augmented Realities
   - 6.1 Fundamentals of Human-Computer Interaction
   - 6.2 Selection
   - 6.3 Manipulation of Objects
   - 6.4 Navigation
   - 6.5 Perceptual Variables

7. Aspects of Development
   - 7.1 Iterative Development Approaches for VR/AR Applications
   - 7.2 Design Techniques
   - 7.3 Prototyping
   - 7.4 Evaluation

8. The Future of Augmented, Mixed and Virtual Reality
   - 8.1 Outlook on Future Applications
   - 8.2 Focus Points for Future Research

Literature
Compulsory Reading
Further Reading ▪ Billinghurst, M., Clark, A., & Lee, G. (n.d.). A Survey of Augmented Reality. Foundations and Trends in Human-Computer Interaction, 8(2-3), 73-272. ▪ Jerald, J. (2016). The VR Book: Human-Centered Design for Virtual Reality. ACM and Morgan & Claypool. ▪ Schmalstieg, D., & Höllerer, T. (2016). Augmented Reality: Principles and Practice. Addison-Wesley.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Project: X-Reality

Course Code: DLBMIAMVR02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The students create an application from the field of augmented or virtual reality by themselves and document its conception and implementation as well as collected experiences. The development of an AR/VR application may include special steps that are not known from classic software applications. In this context, AR- or VR-typical elements of the application should be explicitly highlighted and challenges and problems should be addressed.

Course Outcomes

On successful completion, students will be able to

- implement a small AR/VR application by themselves.
- experiment with the concept of AR/VR applications.
- discuss challenges and issues in AR/VR software development.
- document the concept and implementation of independently developed AR/VR applications and accumulated experience in a project report.

Contents

- The students work on a project from the field of augmented or virtual reality. They design and implement an AR/VR application based on a concrete task. The development of the application as well as collected experiences are documented in a project report. The project report first presents the project goal as well as the topic and context of the application. Then the requirements, the conception and the implementation of the application are described. During the documentation, AR- or VR-typical elements will be explicitly highlighted. The report concludes by highlighting the challenges and issues that arose during development.

Literature
Compulsory Reading
Further Reading ▪ Buttfield-Addison, P., Manning, J., Nugent, T. (2019): Unity Game Development Cookbook: Essentials for Every Game. O'Reilly. ▪ Linowes, J. (2015): Unity virtual reality projects. Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D. Packt Publishing. ▪ Linowes, J./Babilinski, K. (2017): Augmented Reality for Developers. Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Slides	☑ Guideline
☑ Intensive Live Sessions/Learning Sprint		
☑ Recorded Live Sessions		

Digital Business

Module Code: DLBBWWDM_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Muhammad Ashfaq (Digital Business Models) / Prof. Dr. Inga Schlömer (Project: Design Thinking)

Contributing Courses to Module

- Digital Business Models (DLBLODB01_E)
- Project: Design Thinking (DLBINGDT01_E)

Module Exam Type

Module Exam	Split Exam
	Digital Business Models • Study Format "Distance Learning": Exam or Advanced Workbook, 90 Minutes • Study Format "myStudies": Exam or Advanced Workbook, 90 Minutes Project: Design Thinking • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Digital Business Models

- Meaning, Origin and Definition of the Term "Digital Business Model"
- Basic Concepts for the Description of Business Models
- Tools for the Description of Business Models
- Patterns of Digital Business Models
- Digital Business Models and Business Plans

Project: Design Thinking

- Basic Principles of Design Thinking
- The Design Thinking Micro Process
- The Design Thinking Macro Process
- Methods for Early Phases of the Process
- Methods for Idea Generation
- Methods for Prototyping and Testing
- Space Concepts for Design Thinking
- Examples and Case Studies

Learning Outcomes

Digital Business Models

On successful completion, students will be able to

- understand what a business model is and how to describe it systematically.
- outline the basic features of the historical development of business models.
- describe key digital business models and evaluate their advantages and disadvantages.
- establish the relationship between a business model and a business plan to independently derive and analyse the positioning of a company.

Project: Design Thinking

On successful completion, students will be able to

- know the mindset of Design Thinking.
- know the individual phases of the incremental micro cycle and carry them out on an example project.
- know the individual stages of prototyping and apply them in an example project.
- know and use methods and tools for the individual steps of the micro cycle.
- know different space concepts for Design Thinking work environments.
- know examples for the application of Design Thinking by means of business case studies.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Business Administration & Management and Design.	All Bachelor Programmes in the Business & Management and Design, Architecture & Construction fields.

Digital Business Models

Course Code: DLBLODB01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

A business model contains the depiction of the logic of how a company generates, delivers and secures value. The progressing digitalization of many processes, products and services has made possible a large number of innovations in the area of business models in recent years. The subject of this course rounds up the presentation, the underlying patterns and the main factors that influence these digital business models.Starting from a general definition of the concept of a business model, a system is developed to describe the essential factors of a business model. An overview of the historical development of important business models and in particular the influence of digitization on newer business models allows a classification of the concept and an understanding of the framework.Then the most important alternative digital business models of recent years are systematically presented, analyzed and evaluated with regard to their respective strengths and weaknesses.Finally, the role of business models in the creation process of a business plan is described. Students learn the central approaches to developing an independent corporate positioning and are enabled to examine and evaluate the central factors influencing corporate success in digital business.

Course Outcomes

On successful completion, students will be able to

- understand what a business model is and how to describe it systematically.
- outline the basic features of the historical development of business models.
- describe key digital business models and evaluate their advantages and disadvantages.
- establish the relationship between a business model and a business plan to independently derive and analyse the positioning of a company.

Contents

1. Meaning, Origin and Definition of the Term "Digital Business Model
   - 1.1 Goals and Functions of Digital Business Models
   - 1.2 Business Model - Origin of the Term and its Meaning in the Digital Economy
   - 1.3 Definition of the terms Business Model and Digital Business Model
   - 1.4 Differentiation from Other Terminologies of the Digital Economy
2. Basic Concepts for the Description of Business Models
   - 2.1 Value Chain by Porter

2.2 Value-added Chain
2.3 Dominant Logic
2.4 Revenue Model
2.5 Unique Selling Proposition
2.6 Transaction
2.7 Product or Service Range

3. Tools for the Description of Business Models
   3.1 Business Model Canvas
   3.2 St. Gallen Business Model Navigator
   3.3 MIT Framework

4. Patterns of Digital Business Models
   4.1 Long Tail
   4.2 Multi-Sided Pattern
   4.3 Free and Freemium
   4.4 OPEN API Pattern

5. Digital Business Models and Business Plans
   5.1 Integration of the Business Model into the Business Plan
   5.2 Company Positioning and the Digital Business Model
   5.3 Digital Business Models as Innovation Drivers for the Development of New Businesses

Literature

Compulsory Reading

Further Reading

- Gassmann, O., Frankenberger, K., & Choudury, M. (2020). The business model navigator: The strategies behind the most successful companies (Second edition). FT Financial Times publishing. Pearson Education, Limited.
- Weil, P., & Woerner, S. L. (2018). What's your digital business model? Six questions to help you to build the next-generation enterprise. Harvard Business Review Press.
- Wirtz, B. W. (2019). Digital Business Models: Concepts, Models, and the Alphabet Case Study (1st edition 2019). Progress in IS. Springer International Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam or Advanced Workbook, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Project: Design Thinking

Course Code: DLBINGDT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course students will receive a practical introduction to Design Thinking. In addition to teaching the individual basic principles, the procedures in Design Thinking will also be examined in detail. In order not only to understand Design Thinking but also to experience it, selected methods for the individual process steps will be presented and practiced on an example project.

Course Outcomes

On successful completion, students will be able to

- know the mindset of Design Thinking.
- know the individual phases of the incremental micro cycle and carry them out on an example project.
- know the individual stages of prototyping and apply them in an example project.
- know and use methods and tools for the individual steps of the micro cycle.
- know different space concepts for Design Thinking work environments.
- know examples for the application of Design Thinking by means of business case studies.

Contents

1. Basic Principles of Design Thinking
2. The Design Thinking Micro Process
3. The Design Thinking Macro Process
4. Methods for Early Phases of the Process
5. Methods for Idea Generation
6. Methods for Prototyping and Testing
7. Examples and Case Studies

Literature
Compulsory Reading
Further Reading ▪ Brown, T. (2008). Design Thinking. Harvard Business Review, June, 84–95. ▪ Brown, T., & Kātz, B. (2019). Change by design: How design thinking transforms organizations and inspires innovation (Revised and updated edition). Harper Business. ▪ IDEO. (2015). The field guide to human-centered design: Design kit (1st ed.). IDEO. ▪ Lewrick, M., Patrick, L., & Leifer, L. (2018). The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems. John Wiley & Sons. ▪ Lewrick, M., Patrick, L., & Leifer, L. (2020). Design Thinking Toolbook. John Wiley & Sons.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Data Engineer

Module Code: DLBDSEDE

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimaldauer: 1 Semester	WiSe/SoSe	English

Module Coordinator

Sahar Qaadan (Data Engineering) / Sahar Qaadan (Project: Data Engineering)

Contributing Courses to Module

- Data Engineering (DLBDSEDE01)
- Project: Data Engineering (DLBDSEDE02)

Module Exam Type

Module Exam	Split Exam
	Data Engineering • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes Project: Data Engineering • Study Format "Distance Learning": Portfolio

Weight of Module

see curriculum

Module Contents

Data Engineering

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Project: Data Engineering

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Learning Outcomes

Data Engineering

On successful completion, students will be able to

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Project: Data Engineering

On successful completion, students will be able to

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field(s) of Data Science & Artificial Intelligence.	All Bachelor Programs in the IT & Technology field(s).

Data Engineering

Course Code: DLBDSEDE01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course explores concepts of data engineering. Data engineering is concerned with the infrastructure aspects of data science such as data storage and provision, as well as the provisioning of suitable operational environments.After laying out foundational notions and concepts of the discipline, this course addresses important developments in storage technology; aspects of systems architecture for processing data at scale; containerization as a modern take on virtualization; and the logic of data pipelines and associated operational aspects. Important issues pertaining to data security and protection are also given appropriate attention.

Course Outcomes

On successful completion, students will be able to

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Contents

1. Foundations of Data Engineering
   - 1.1 Reliability
   - 1.2 Scalability
   - 1.3 Maintainability
2. NoSQL In Depth
   - 2.1 Fundamentals of NoSQL
   - 2.2 Established NoSQL solutions
3. Architectures for Data Processing at Scale
   - 3.1 Batch processing architectures
   - 3.2 Architectures for stream and complex event processing
   - 3.3 Lambda architecture

4. Containerization In Depth
   - 4.1 Docker containers
   - 4.2 Container management

5. Governance & Security
   - 5.1 Data protection
   - 5.2 Data security
   - 5.3 Data governance

6. Operational Aspects
   - 6.1 Defining principles of DataOps
   - 6.2 Building and maintaining data pipelines
   - 6.3 Metrics and monitoring

Literature

Compulsory Reading

Further Reading

- Adkins, H., Beyer, B., Blankinship, P., Lewandowski, P., Oprea, A., & Stubblefield, A. (2020). Building secure and reliable systems. O'Reilly.
- Franks, B. (2020). 97 things about ethics everyone in data science should know. O'Reilly.
- Kane, S. P., & Matthias, K. (2018). Docker: Up and running (2nd ed.). O'Reilly.
- Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. O'Reilly.
- Narkhede, N., Palino, T., & Shapira, G. (2017). Kafka: The definitive guide. O'Reilly.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Project: Data Engineering

Course Code: DLBDSEDE02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The focus of this course is the implementation of a real-world data engineering use case in the form of a student portfolio. To this end, students choose a project subject from the various sub-domains of data engineering. Examples include setting up a Docker container environment or dockerized service; implementing a data pipeline according to DataOps principles; and setting up an NoSQL data store.The goal is for students to demonstrate they can transfer theoretical knowledge to an implementation scenario that closely mimics practical work in a professional data engineering setting.

Course Outcomes

On successful completion, students will be able to

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Contents

- This course covers the practical implementation of approaches and techniques covered in the preceding methodological course in a project-oriented setting. Each participant must produce a portfolio detailing and documenting the work. Porfolio themes are chosen from a list, or suggested by the students in accord with the tutor.

Literature

Compulsory Reading

Further Reading

- Kane, S. P., & Matthias, K. (2018). Docker: Shipping reliable containers in production (2nd ed.). O'Reilly.
- Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems (1st ed.). O'Reilly.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
Tutorial Support ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	**Exam Preparation** ☑ Guideline

User Experience

Module Code: DLBMIUEX_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Dr. Mathias Bauer (User Experience) / David Linderman (UX-Project)

Contributing Courses to Module

- User Experience (DLBMIUEX01_E)
- UX-Project (DLBMIUEX02_E)

Module Exam Type

Module Exam	Split Exam
	User Experience • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes UX-Project • Study Format "myStudies": Written Assessment: Project Report • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

User Experience

- Basics of User Experience
- Customer Journey
- Selected UX Techniques
- UX Evaluation
- Information Design
- UX on a Large Scale

UX-Project

Practical project with focus on UX.

Learning Outcomes

User Experience

On successful completion, students will be able to

- describe, classify, and delimit the term user experience and its concepts.
- analyze touchpoints, create customer journey maps and describe personas.
- describe suitable techniques for user experience design and select them for a specific task.
- describe techniques for evaluating UX and identify appropriate ones for specific tasks.
- describe and delimit selected techniques for information design.
- describe and delimit concepts and approaches for designing user experience at the process, service and enterprise levels.
- engage in interdisciplinary team work and communicate comprehensively with UX professionals with complementary backgrounds and skill sets.

UX-Project

On successful completion, students will be able to

- independently carry out small and medium-sized project tasks in the field of UX and produce an appropriate result.
- define a suitable approach to UX projects and identify appropriate techniques and methods specifically.
- critically reflect and document the work process and the achieved result regarding the target achievement.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Design	All Bachelor Programs in the Design, Architecture & Construction fields

User Experience

Course Code: DLBMIUEX01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The term user experience (UX) generally refers to the experience that users and customers have in relationship to the products and services that a company offers. It is not only about improving the usability of IT systems, but also about analyzing, designing and evaluating the experience of users and customers. After an introduction to the topic of user experience, some methods for analyzing the user experience will be explained and their application will be discussed. Then, selected techniques for designing user experience and suitable approaches to information design are introduced. After that specific techniques for evaluating UX are discussed. Finally, it will be explained how UX can be designed specifically at the level of services and companies.

Course Outcomes

On successful completion, students will be able to

- describe, classify, and delimit the term user experience and its concepts.
- analyze touchpoints, create customer journey maps and describe personas.
- describe suitable techniques for user experience design and select them for a specific task.
- describe techniques for evaluating UX and identify appropriate ones for specific tasks.
- describe and delimit selected techniques for information design.
- describe and delimit concepts and approaches for designing user experience at the process, service and enterprise levels.
- engage in interdisciplinary team work and communicate comprehensively with UX professionals with complementary backgrounds and skill sets.

Contents

1. UX Basics
   - 1.1 Terms, Concepts, History
   - 1.2 User Experience Design and Management
   - 1.3 Selected Scenarios from Practice
2. Analysis
   - 2.1 Contextual Inquiry
   - 2.2 Touchpoint Analysis
   - 2.3 Customer Journey Map
   - 2.4 Persona

3. Finding Ideas
    - 3.1 Use Cases
    - 3.2 User Stories
    - 3.3 Storyboards

4. Design and Prototyping
    - 4.1 Card Sorting
    - 4.2 Sketches and Scribbles
    - 4.3 Wireframes
    - 4.4 Prototyping
    - 4.5 Guidelines and Style Guides

5. Evaluation
    - 5.1 Usability Testing
    - 5.2 Observation Techniques
    - 5.3 Interview Techniques and Questionnaires

6. "UX on a Large Scale"
    - 6.1 UX in Services and Business Processes
    - 6.2 Corporate UX

Literature
Compulsory Reading
Further Reading ▪ Buxton, William. Sketching User Experience: Getting the Design Right and the Right Design. San Francisco, Calif.: Morgan Kaufmann, 2007. Book. ▪ Garrett, Jesse James. The Elements of User Experience : User-Centered Design for the Web and Beyond. Voices That Matter Ser. Vol. 2nd ed., New edition, revised, Berkeley: New Riders, 2010. Book. ▪ Kuniavsky, Mike, Andrea Moed, and Elizabeth Goodman. Observing the User Experience [Electronic Resource] : A Practitioner's Guide to User Research. Waltham, MA Morgan Kaufmann, 2nd ed, 2012. ▪ Norman, Don. The Design of Everyday Things : Revised and Expanded Edition. Vol. Revised and expanded edition, New York: Basic Books, 2013. Book. ▪ Saul, Greenberg, Carpendale Sheelagh, Marquardt Nicolai, and Buxton Bill. Sketching User Experiences: The Workbook. Waltham, Mass: Morgan Kaufmann, 2012. Book. ▪ Brown, Diana DeMarco. Agile User Experience Design a Practitioner's Guide to Making It Work. Amsterdam [u.a.]: Elsevier MK, 2013. Monograph. ▪ Robier, Johannes. "Ux Redefined. Winning and Keeping Customers with Enhanced Usability and User Experience." Belgium, Europe: Springer International Publishing, 2016.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

UX-Project

Course Code: DLBMIUEX02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The aim of the module is to apply the already acquired knowledge and skills on the subject of User Experience in a practical project. The students work on a self-organized project with focus on User Experience.

Course Outcomes

On successful completion, students will be able to

- independently carry out small and medium-sized project tasks in the field of UX and produce an appropriate result.
- define a suitable approach to UX projects and identify appropriate techniques and methods specifically.
- critically reflect and document the work process and the achieved result regarding the target achievement.

Contents

- The knowledge acquired in the course User Experience is applied to projects. The approach, the results achieved and the critical reflection are documented in a written project report.

Literature

Compulsory Reading

Further Reading

- Barnum, Carol M. . Usability Testing Essentials : Ready, Set...Test! Amsterdam: Morgan Kaufmann, 2011. eBook.
- Cooper, Alan, Robert Reimann, David Cronin, and Christopher Noessel. About Face: The Essentials of Interaction Design. 4th ed. Hoboken: Wiley, 2014. eBook.
- Hartson, Rex, and Pardha S. Pyla. the Ux Book: Agile Ux Design for a Quality User Experience. 2nd ed. Cambridge: Morgan Kaufman, 2019. eBook.
- Robier, Johannes. "Ux Redefined. Winning and Keeping Customers with Enhanced Usability and User Experience." Belgium, Europe: Springer International Publishing, 2016. eBook.

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

AI Specialist

Module Code: DLBDSEAIS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Kristina Schaaff (Artificial Intelligence) / Prof. Dr. Simon Martin (Project: Artificial Intelligence)

Contributing Courses to Module

- Artificial Intelligence (DLBDSEAIS01)
- Project: Artificial Intelligence (DLBDSEAIS02)

Module Exam Type

Module Exam	Split Exam
	Artificial Intelligence • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "Duales myStudium": Exam, 90 Minutes Project: Artificial Intelligence • Study Format "Distance Learning": Portfolio • Study Format "myStudies": Portfolio • Study Format "Duales myStudium": Portfolio

Weight of Module

see curriculum

Module Contents

Artificial Intelligence

- History of AI
- Modern AI systems
- Reinforcement learning
- Natural language processing
- Computer vision

Project: Artificial Intelligence

This course focuses on developing a simple AI system for a specific application and domain. A current list of topics is located in the Learning Management System.

Learning Outcomes

Artificial Intelligence

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Project: Artificial Intelligence

On successful completion, students will be able to

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the fields of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology fields

Artificial Intelligence

Course Code: DLBDSEAIS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The quest for artificial intelligence (AI) has captured humanity's interest for many decades and has been an active research area since the 1960s. This course will give a detailed overview of the historical developments, successes, and set-backs in AI, as well as modern approaches in the development of artificial intelligence.This course gives an introduction to reinforcement learning, a process similar to how humans and animals experience the world: exploring the environment and inferring the best course of action.This course also covers the principles of natural language processing and computer vision, both of which are key ingredients for an artificial intelligence to be able to interact with its environment.

Course Outcomes

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Contents

1. History of AI
   - 1.1 Historical Developments
   - 1.2 AI Winter
   - 1.3 Expert Systems
   - 1.4 Notable Advances
2. Modern AI Systems
   - 2.1 Narrow versus General AI
   - 2.2 Application Areas
3. Reinforcement Learning
   - 3.1 What is Reinforcement Learning?
   - 3.2 Markov Chains and Value Function

3.3 Time-Difference and Q Learning

4. Natural Language Processing (NLP)
   - 4.1 Introduction to NLP and Application Areas
   - 4.2 Basic NLP Techniques
   - 4.3 Vectorizing Data

5. Computer Vision
   - 5.1 Introduction to Computer Vision
   - 5.2 Image Representation and Geometry
   - 5.3 Feature Detection
   - 5.4 Semantic Segmentation

Literature

Compulsory Reading

Further Reading

- Bear, F., Barry, W., & Paradiso, M. (2020). Neuroscience: Exploring the brain (4th ed.). Lippincott Williams & Wilkins.
- Chollet, F. (2018). Deep learning with Python. Manning.
- Géron, A. (2017). Hands-on machine learning with Scikit-Learn and TensorFlow. O'Reilly.
- Géron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems (2nd ed.). O'Reilly.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.
- Grus, J. (2019). Data science from scratch: First principles with Python. O'Reilly.
- Jurafsky, D., & Martin, J. H. (2022). Speech and language processing (3rd ed.). Prentice Hall.
- Russell, S. J., & Norvig, P. (2022). Artificial Intelligence: A modern approach (4th ed., global ed.). Pearson.
- Sutton, R. S., & Barto, A. G. (2018). Reinforcement learning: An introduction (2nd ed.). MIT Press. (Adaptive Computation and Machine Learning series).
- Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed.). Springer. (Texts in Computer Science series).

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Project: Artificial Intelligence

Course Code: DLBDSEAIS02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This project course will give students hands-on experience in the challenging task of designing and developing an AI system for a specific application and domain. Students will need to consider requirements and practical constraints as well as the desired output of the AI system.Following this course the students will get holistic overview of developing a specific AI-based application.

Course Outcomes

On successful completion, students will be able to

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

Contents

- This project course focuses on understanding and implementing a simple AI system. Based on the course Artificial Intelligence (DLBDSEAI01), students will design and implement a simple AI system. In the first step, students will choose a specific application and domain and then use the methods from the course to analyze the requirements and outcomes before implementing their own AI application. All relevant artifacts and considerations are documented by the students in a course portfolio.

Literature
Compulsory Reading
Further Reading ▪ Bear, M. F., Barry, W. S., & Paradiso, M. A. (2020). Neuroscience: Exploring the brain (4th ed.). Lippincott Williams & Wilkins. ▪ Chollet, F. (2018). Deep learning with Python. Manning. ▪ Géron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems (2nd ed.). O'Reilly. ▪ Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press. ▪ Grus, J. (2019). Data science from scratch: First principles with Python. O'Reilly. ▪ Jurafsky, D., & Martin, J. H. (2022). Speech and language processing (3rd ed.). Prentice Hall. ▪ Russell, S. J., & Norvig, P. (2022). Artificial intelligence: A modern approach (4th ed., global ed.). Pearson. ▪ Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed. 2022). Springer.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Studium Generale I and II

Module Code: DLBSG_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

N.N. (Studium Generale I) / N.N. (Studium Generale II)

Contributing Courses to Module

- Studium Generale I (DLBSG01_E)
- Studium Generale II (DLBSG02_E)

Module Exam Type

Module Exam	Split Exam
	Studium Generale I • Study Format "myStudies": See Selected Course • Study Format "Distance Learning": See Selected Course Studium Generale II • Study Format "Distance Learning": See Selected Course • Study Format "myStudies": See Selected Course

Weight of Module

see curriculum

Module Contents

Studium Generale I

In principle, all IU bachelor courses can be selected as courses for the "Studium Generale", so that the content can be chosen from the entire breadth of the IU distance learning program.

Studium Generale II

In principle, all IU bachelor courses can be selected as courses for the "Studium Generale", so that the content can be chosen from the entire breadth of the IU distance learning program.

Learning Outcomes

Studium Generale I

On successful completion, students will be able to

- apply acquired key competencies to issues in their field of study and/or in their professional environment.
- to deepen one's own skills and abilities in a self-directed manner.
- to look beyond the boundaries of their own area of expertise.

Studium Generale II

On successful completion, students will be able to

- apply acquired key competencies to issues in their field of study and/or in their professional environment.
- to deepen one's own skills and abilities in a self-directed manner.
- to look beyond the boundaries of their own area of expertise.

Links to other Modules within the Study Program	Links to other Study Programs of the University
It is a stand-alone offering with possible references to various required and elective modules	All IU Distance Learning Bachelor Programs

Studium Generale I

Course Code: DLBSG01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In the course "Studium Generale I", students deepen their knowledge in a self-selected subject area by completing an IU course outside their applicable curriculum. This gives them the opportunity to look beyond their own subject area and acquire further competencies. The associated option enables students to self-determine their study content to focus even more on issues relevant to them and/or to strengthen or develop selected competencies.

Course Outcomes

On successful completion, students will be able to

- apply acquired key competencies to issues in their field of study and/or in their professional environment.
- to deepen one's own skills and abilities in a self-directed manner.
- to look beyond the boundaries of their own area of expertise.

Contents

- The course "Studium Generale I" offers students the opportunity to take courses outside of their curriculum and the result can be credited as an elective subject. In principle, all IU bachelor courses that fulfill the following requirements are creditable for this purpose:
  - They are not part of an integral part of the applicable mandatory curriculum.
  - They do not have admission requirements or students can prove that they have met the admission requirement.
- The examination of the selected courses must be taken in full and finally passed in order to be credited as part of the 'Studium Generale' .

Literature

Compulsory Reading

Further Reading

- See course description of the selected course

Study Format myStudies

Study Format	Course Type
myStudies	See Selected Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	See Selected Course

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
0 h	0 h	0 h	0 h	0 h	0 h

Instructional Methods
see selected course

Study Format Distance Learning

Study Format	Course Type
Distance Learning	See Selected Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	See Selected Course

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
0 h	0 h	0 h	0 h	0 h	0 h

Instructional Methods
See Selected Course

Studium Generale II

Course Code: DLBSG02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In the course "Studium Generale II", students deepen their knowledge in a self-selected subject area by completing an IU course outside their applicable curriculum. This gives them the opportunity to look beyond their own subject area and acquire further competencies. The associated option enables students to self-determine their study content to focus even more on issues relevant to them and/or to strengthen or develop selected competencies.

Course Outcomes

On successful completion, students will be able to

- apply acquired key competencies to issues in their field of study and/or in their professional environment.
- to deepen one's own skills and abilities in a self-directed manner.
- to look beyond the boundaries of their own area of expertise.

Contents

- The course "Studium Generale II" offers students the opportunity to take courses outside of their curriculum and the result can be credited as an elective subject. In principle, all IU bachelor courses that fulfill the following requirements can be chosen for this purpose:
  - They are not part of an integral part of the applicable mandatory curriculum.
  - They do not have admission requirements or students can prove that they have met the admission requirement.
- The examination of the selected courses must be taken in full and finally passed in order to be credited as part of the 'Studium Generale' .

Literature

Compulsory Reading

Further Reading

- See course description of the selected course

Study Format Distance Learning

Study Format	Course Type
Distance Learning	See Selected Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	See Selected Course

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
0 h	0 h	0 h	0 h	0 h	0 h

Instructional Methods
See Selected Course

Study Format myStudies

Study Format	Course Type
myStudies	See Selected Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	See Selected Course

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
0 h	0 h	0 h	0 h	0 h	0 h

Instructional Methods

Mastering Prompts

Module Code: DLBWMP_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Kristina Schaaff (Artificial Intelligence) / Prof. Dr. Knut Linke (Project: AI Excellence with Creative Prompting Techniques)

Contributing Courses to Module

- Artificial Intelligence (DLBDSEAIS01)
- Project: AI Excellence with Creative Prompting Techniques (DLBPKIEKPT01_E)

Module Exam Type

Module Exam	Split Exam
	Artificial Intelligence • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "Duales myStudium": Exam, 90 Minutes Project: AI Excellence with Creative Prompting Techniques • Study Format "myStudies": Oral Project Report • Study Format "Duales myStudium": Oral Project Report • Study Format "Distance Learning": Oral Project Report

Weight of Module
see curriculum

Module Contents

Artificial Intelligence

Project: AI Excellence with Creative Prompting Techniques

Learning Outcomes

Artificial Intelligence

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Project: AI Excellence with Creative Prompting Techniques

On successful completion, students will be able to

- comprehend and apply basic prompting techniques in generative AI applications.
- analyze and evaluate the effectiveness of the basic prompts.
- apply ethical considerations to the design and use of AI for basic prompting techniques.
- design, implement, and refine effective prompts to real-world scenarios through hands-on exercises.
- showcase creative and innovative thinking in the application of prompting techniques to solve complex problems in their field of studies.

Links to other Modules within the Study Program	Links to other Study Programs of the University
This module is similar to other modules in the field of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

Artificial Intelligence

Course Code: DLBDSEAIS01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

The quest for artificial intelligence (AI) has captured humanity's interest for many decades and has been an active research area since the 1960s. This course will give a detailed overview of the historical developments, successes, and set-backs in AI, as well as modern approaches in the development of artificial intelligence.This course gives an introduction to reinforcement learning, a process similar to how humans and animals experience the world: exploring the environment and inferring the best course of action.This course also covers the principles of natural language processing and computer vision, both of which are key ingredients for an artificial intelligence to be able to interact with its environment.

Course Outcomes

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Contents

1. History of AI
   - 1.1 Historical Developments
   - 1.2 AI Winter
   - 1.3 Expert Systems
   - 1.4 Notable Advances
2. Modern AI Systems
   - 2.1 Narrow versus General AI
   - 2.2 Application Areas
3. Reinforcement Learning
   - 3.1 What is Reinforcement Learning?
   - 3.2 Markov Chains and Value Function

3.3 Time-Difference and Q Learning

4. Natural Language Processing (NLP)
   - 4.1 Introduction to NLP and Application Areas
   - 4.2 Basic NLP Techniques
   - 4.3 Vectorizing Data

5. Computer Vision
   - 5.1 Introduction to Computer Vision
   - 5.2 Image Representation and Geometry
   - 5.3 Feature Detection
   - 5.4 Semantic Segmentation

Literature

Compulsory Reading

Further Reading

- Bear, F., Barry, W., & Paradiso, M. (2020). Neuroscience: Exploring the brain (4th ed.). Lippincott Williams & Wilkins.
- Chollet, F. (2018). Deep learning with Python. Manning.
- Géron, A. (2017). Hands-on machine learning with Scikit-Learn and TensorFlow. O'Reilly.
- Géron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems (2nd ed.). O'Reilly.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.
- Grus, J. (2019). Data science from scratch: First principles with Python. O'Reilly.
- Jurafsky, D., & Martin, J. H. (2022). Speech and language processing (3rd ed.). Prentice Hall.
- Russell, S. J., & Norvig, P. (2022). Artificial Intelligence: A modern approach (4th ed., global ed.). Pearson.
- Sutton, R. S., & Barto, A. G. (2018). Reinforcement learning: An introduction (2nd ed.). MIT Press. (Adaptive Computation and Machine Learning series).
- Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed.). Springer. (Texts in Computer Science series).

Study Format myStudies

Study Format	Course Type
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Project: AI Excellence with Creative Prompting Techniques

Course Code: DLBPKIEKPT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In this course, students explore the fascinating world of prompting in generative AI applications. They engage in hands-on exercises to create new AI-generated content including text, images, and videos. Through these exercises, students learn how to effectively use, analyze, and evaluate these systems within their respective fields of study.

Course Outcomes

On successful completion, students will be able to

- comprehend and apply basic prompting techniques in generative AI applications.
- analyze and evaluate the effectiveness of the basic prompts.
- apply ethical considerations to the design and use of AI for basic prompting techniques.
- design, implement, and refine effective prompts to real-world scenarios through hands-on exercises.
- showcase creative and innovative thinking in the application of prompting techniques to solve complex problems in their field of studies.

Contents

- In this course, students work on a basic practical implementation of a generative AI use case by choosing from a selection provided in the complementary guideline. The course provides practical examples as learning materials and exercises with basic prompting techniques for open-source text, image, and video generation use cases. The exercises are designed to inspire and guide students in completing their own generative AI use case work, which includes a use case description, chosen prompting techniques, outcomes, and critical evaluations from both technical and ethical perspectives.

Literature
Compulsory Reading
Further Reading ▪ Dang, H., Mecke, L., Lehmann, F., Goller, S., & Buschek, D. (2022). How to prompt? Opportunities and challenges of zero- and few-shot learning for human-AI interaction in creative applications of generative models. arXiv. https://arxiv.org/pdf/2209.01390.pdf ▪ Eapen, T. T., Finkenstadt, D. J., Folk, J., & Venkataswamy, L. (2023). How generative AI can augment human creativity. Harvard Business Review, July–August, 56–64. ▪ Wei, J., Wang, X., Schuurmans, D., Bosma, M. Ichter, B., Xia, F., Chi, E. H., Le., Q. V., & Zhou, D. (2023). Chain-of-though prompting elicit reasoning in large language models. arXiv. https://arxiv.org/pdf/2201.11903.pdf

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Oral Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Oral Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Oral Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Microsoft ERP- Dynamics 365 Business Central - Functional Consultant

Module Code: DLBMSERP

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum		BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Dr. Aditya Mushyam (Project: Dynamics 365 Business Central - Financial Company Setup) / Dr. Aditya Mushyam (Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution)

Contributing Courses to Module

- Project: Dynamics 365 Business Central - Financial Company Setup (DLBMSERP01)
- Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution (DLBMSERP02)

Module Exam Type

Module Exam	Split Exam Project: Dynamics 365 Business Central - Financial Company Setup • Study Format "Duales myStudium": Written Assessment: Project Report • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report • Study Format "Duales myStudium": Written Assessment: Project Report
Weight of Module see curriculum	

Module Contents

Project: Dynamics 365 Business Central - Financial Company Setup

This module empowers students to configure and perform core business processes of a small or medium-sized company in an enterprise resource planning (ERP) system using Microsoft Dynamics 365 Business Central. Therefore, the module will address the core financial setup as well as sales and distribution processes for a small or medium-sized company.

Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution

This module empowers students to configure and perform core business processes of a small or medium-sized company in an enterprise resource planning (ERP) system using Microsoft Dynamics 365 Business Central. Therefore, the module will address the core financial setup as well as sales and distribution processes for a small or medium-sized company.

Learning Outcomes

Project: Dynamics 365 Business Central - Financial Company Setup

On successful completion, students will be able to

- describe the core feature of Business Central as an ERP system for small or medium-sized company.
- initially setup Business Central (SaaS).
- configure a new small or medium-sized demo company in Business Central.
- manage core security settings in Business Central.
- configure financials by setting up the finance module in Business Central.
- configure the chart of accounts in Business Central.

Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution

On successful completion, students will be able to

- configure sales module in Business Central.
- configure purchasing module in Business Central.
- set up inventory management in Business Central.
- configure master data for sales and purchasing in Business Central.
- describe how to perform Business Central operations including selling and purchasing.
- process financial documents.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Project: Dynamics 365 Business Central - Financial Company Setup

Course Code: DLBMSERP01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course aims to empower students to perform financial business processes of a small or medium-sized company using the well-established cloud-based ERP system Microsoft Dynamics 365 Business Central (BC). At first, you will gain important insights into the typical structure of BC. Based on that knowledge, you will be guided to setup a SaaS environment for a demo company in BC. To ensure a safe operation of BC in the cloud you will learn how to configure essential security settings. Next, you will familiarize yourself with the most important and common financial business processes for a small or medium-sized business. Finally, you will configure the accounting module for your demo company in BC.

Course Outcomes

On successful completion, students will be able to

- describe the core feature of Business Central as an ERP system for small or medium-sized company.
- initially setup Business Central (SaaS).
- configure a new small or medium-sized demo company in Business Central.
- manage core security settings in Business Central.
- configure financials by setting up the finance module in Business Central.
- configure the chart of accounts in Business Central.

Contents

- Embarking on the journey of utilizing BC involves a series of pivotal steps. It commences with the fundamental task of setting up the platform itself. This encompasses the creation and meticulous configuration of a company, including the setup of security settings to ensure a secure operational environment. The process further extends to establishing the core functionality, which serves as the backbone of operations. The inclusion of dimensions adds an additional layer of precision to data handling. A critical aspect of the BC framework lies in managing approvals seamlessly through the implementation of workflows, streamlining processes and enhancing efficiency. Within the finance module, a thorough configuration is undertaken. This involves the setup of financial management procedures, which ensures the financial aspect of operations is well-structured and organized. Part of this process includes the establishment of the chart of accounts, providing a foundation for accurate

financial tracking. Moreover, the setup of posting groups refines the financial recording process, facilitating precise categorization. The establishment of journals and bank accounts enhances financial transparency, offering a clear overview of monetary transactions. Notably, payable accounts are configured, ensuring seamless management of outgoing payments. Similarly, the setup of receivable accounts streamlines the handling of incoming payments. Collectively, these steps form a comprehensive roadmap to unleash the full potential of BC, enabling efficient operations and meticulous financial management.

Literature

Compulsory Reading

Further Reading

- Gayer, M., Hauptmann, C., & Ebert, J. (2020). Microsoft Dynamics 365 Business Central: Das Anwenderbuch zur Abwicklung von Geschäftsprozessen (11. Ausgabe). Carl Hanser Verlag.
- Ferner, C. (2020): Microsoft Dynamics 365 Business Central Basiswissen (Auflage 1). BoD – Books on Demand.
- Merk, J. (2020). Microsoft Dynamics 365 BC Finanzbuchhaltung. NEW ERA Publications
- Microsoft Corporation. (2023). Learning path for certification: Dynamics 365 Business Central Functional Consultant.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Project: Dynamics 365 Business Central - Business Processes with Focus on Sales and Distribution

Course Code: DLBMSERP02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBMSERP01

Course Description

This course aims to empower students to perform sales and distribution processes using the well-established cloud-based ERP system Microsoft Dynamics 365 Business Central (BC). At first, you will gain important insights into the configuration of the sales module for a small or medium-sized company. Based on that knowledge, you will be guided to setup the purchasing module and inventory management in BC. Next, you will familiarize yourself with the configuration of the corresponding master data management. Finally, you will perform common business transaction in the sales and distribution module as well as process core financial documents for your demo company in BC.

Course Outcomes

On successful completion, students will be able to

- configure sales module in Business Central.
- configure purchasing module in Business Central.
- set up inventory management in Business Central.
- configure master data for sales and purchasing in Business Central.
- describe how to perform Business Central operations including selling and purchasing.
- process financial documents.

Contents

- To ensure the smooth flow of business processes in BC, various steps are necessary. First, the configuration of the sales and purchases modules takes place to establish the foundation for efficient work. During this phase, inventory management is set up to ensure an organized inventory flow. An essential step is configuring master data for sales and purchasing, as these form the basis for all subsequent activities. Prices and discounts are also established to create a clear pricing structure. Following this, common operations are performed in Business Central, encompassing both basic tasks and frequent operations. The processing of purchases as well as the handling of sales transactions is a central part of the process and a common operation in BC. Financial documents are processed as well to accurately represent the accounting aspect. Another step involves processing payments and journal entries to meticulously manage the financial aspects. All of these steps contribute to the seamless execution of business activities while maintaining financial integrity.

Literature
Compulsory Reading
Further Reading ▪ Gayer, M., Hauptmann, C., & Ebert, J. (2020). Microsoft Dynamics 365 Business Central: Das Anwenderbuch zur Abwicklung von Geschäftsprozessen (11. Ausgabe). Carl Hanser Verlag. ▪ Ferner, C. (2020): Microsoft Dynamics 365 Business Central Basiswissen (Auflage 1). BoD – Books on Demand. ▪ Microsoft Corporation. (2023). Learning path for certification: Dynamics 365 Business Central Functional Consultant.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

SAP - SAP S/4HANA Business Process Integration - Application Associate

Module Code: DLBSAPBPI

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum		BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimaldauer: 1 Semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Knut Linke (Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management) / Prof. Dr. Knut Linke (Project: SAP S/4HANA - Business Processes)

Contributing Courses to Module

- Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management (DLBSAPBPI01)
- Project: SAP S/4HANA - Business Processes (DLBSAPBPI02)

Module Exam Type

Module Exam	Split Exam
	Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management • Study Format "Duales myStudium": Written Assessment: Project Report • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report Project: SAP S/4HANA - Business Processes • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report • Study Format "Duales myStudium": Written Assessment: Project Report
Weight of Module see curriculum	

Module Contents

Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management

This module empowers students to configure and perform core business processes of medium-sized and large companies in an enterprise resource planning (ERP) system using SAP S/4HANA and the user interface SAP Fiori. The module consists of two steps, each catering to specific facets. In the first step, attention is directed towards the core financial setup as well as the preliminary configuration of the Human Capital Management module using a demo company as an illustration. This step lays down a robust foundation in these domains. Moving on to the second step, the focus shifts to expanding the initial setup by integrating business processes related to sales, distribution, and production.

Project: SAP S/4HANA - Business Processes

Learning Outcomes

Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management

On successful completion, students will be able to

- navigate confidently within the SAP S/4HANA ERP system.
- explain the organizational structures.
- understand the concept of master data.
- explain financial accounting (FI) module.
- explain management accounting (CO) module.
- explain the employee master data record (HCM).

Project: SAP S/4HANA - Business Processes

On successful completion, students will be able to

- describe the source to pay business process (MM).
- describe warehouse management systems (WM).
- explain the design to operate business process (PP).
- describe the order to cash business process (SD).
- create a project structure (PS).
- defining the organizational levels used in enterprise asset management (EAM).

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programmes in the IT & Technology fields

Project: SAP S/4HANA - Financial Company Setup incl. Human Capital Management

Course Code: DLBSAPBPI01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

This course aims to empower students to perform financial business processes of medium-sized and large companies using the well-established ERP system SAP S/4HANA (S4H). At first, you will gain important insights into the typical organizational structure and navigation within S4H. You will understand the new user experience concept of SAP Fiori. Based on that knowledge, you will get in contact with the concept of master data in S4H. Next, you will familiarize yourself with the most important and common financial business processes in the financial accounting (FI) and management accounting (CO) module of S4H. Finally, you will configure the employee master data record in the Human Capital Management (HCM) module of S4H.

Course Outcomes

On successful completion, students will be able to

- navigate confidently within the SAP S/4HANA ERP system.
- explain the organizational structures.
- understand the concept of master data.
- explain financial accounting (FI) module.
- explain management accounting (CO) module.
- explain the employee master data record (HCM).

Contents

- The course provides a comprehensive introduction into SAP S/4HANA starting with the overall SAP S/4HANA Enterprise Management: Overview. Therefore, the course offers a comprehensive and presentation of various key concepts and functions relevant in the world of SAP S/4HANA. Furthermore, it focuses on the new user experience brought by SAP Fiori UX. The course covers the basics of SAP S/4HANA as well as the various organizational structures that exist within this system. A central concept addressed is that of master data. The subjects of Financial Accounting and Management Accounting (Record-to-Report processing) are thoroughly examined, providing an overview. Within these areas, Financial Accounting (FI) is explained, and Management Accounting (CO) is illuminated further. The integration between FI and CO is also outlined. The fundamentals of Financial Accounting and Management Accounting (Record-to-Report processing) are further delved into. This includes the definitions of General Ledger (G/L) accounts and cost elements, as well as

the definition of cost centers. Step-by-step instructions for posting G/L account documents and handling business partners and invoices are conveyed. The management of Asset Accounting, Activity Types, and Internal Orders is also comprehensively explained. The course also addresses the realm of Human Capital Management (HCM). This covers organizational management in HCM, as well as the significance of HCM master data. Another important aspect is the integration with SAP Success Factors.

Literature

Compulsory Reading

Further Reading

- Fitzner, W., Fitzner, D. (2021). SAP S/4HANA: Der Grundkurs für Einsteiger und Anwender. SAP Press
- Fix, W., Plota, R. (2021). SAP – Der technische Einstieg: Der Standardtitel für Ausbildung, Studium und Quereinstieg. SAP Press
- SAP SE. (2023). SAP Learning journey "Explore Integrated Business Processes in SAP S/4HANA".
- SAP SE. (2023). SAP Learning journey "Discovering End-to-End Business Processes for the Intelligent Enterprise".

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Project: SAP S/4HANA - Business Processes

Course Code: DLBSAPBPI02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBSAPBPI01

Course Description

This course aims to empower students to perform sales and distribution processes of medium-sized and large companies using the well-established ERP system SAP S/4HANA (S4H).At first, you will gain important insights into the configuration of the purchasing (MM) and warehouse management (WM) modulewithin S4H. You willalso understand the production process (PP) of S4H. Based on that knowledge, you willget in contact with the lead to cash business process (SD) in S4H. Next, you will familiarize yourself with the project system (PS) in S4H while creating project steps and structures. Finally, you will defining the organizational levels and for the management and maintenance of the company's physical assets in the enterprise asset management (EAM) module of S4H.

Course Outcomes

On successful completion, students will be able to

- describe the source to pay business process (MM).
- describe warehouse management systems (WM).
- explain the design to operate business process (PP).
- describe the order to cash business process (SD).
- create a project structure (PS).
- defining the organizational levels used in enterprise asset management (EAM).

Contents

- The course covers a wide range of processes and concepts within SAP S/4HANA: Purchase to Pay Processing in SAP S/4HANA: Exploring the Purchase to Pay business process, including the definition of master data involved. This encompasses creating vendor master records, listing vendor-specific master data records, generating purchase requisitions, crafting purchase orders, posting goods receipts for purchase orders, and managing vendor invoices. The automatic payment run process is also elucidated. Warehouse Management - Stock Transfer: This section delves into Warehouse Management (WM) structures and usage, highlighting the distinctions between Extended Warehouse Management (EWM), WM, and Inventory Management (IM). The process of handling stock transfer orders is outlined. Plan to Produce Business Process in SAP S/4HANA: Understanding the Plan to Produce process within SAP S/4HANA, which encompasses defining master data, creating product cost estimates, planning product demand through integrated planning, establishing Material Requirements Planning (MRP) processes, and executing advanced planning. Advanced

Planning - Describing the Manufacturing Business Process: Exploring the manufacturing business process, starting from the creation and release of production orders to material withdrawal, order confirmation, materials goods receipt, and period-end closing activities. Order to Cash Processing in SAP S/4HANA: This section focuses on the Order to Cash business process, describing the master data used in sales and distribution. The process involves creating customer master records, setting up condition records, processing sales orders, managing delivery documents, generating customer invoices, and handling related activities. Project System (PS): Detailing the steps within Project System, including creating project structures, project planning, budgeting, project execution, and concluding with period-end closing activities. SAP Enterprise Asset Management (EAM): Covering the business steps in SAP EAM, describing the master data utilized, creating notifications, processing maintenance orders, executing maintenance tasks, and wrapping up with period-end closing activities.

Literature

Compulsory Reading

Further Reading

- Fitzner, W., Fitzner, D. (2021). SAP S/4HANA: Der Grundkurs für Einsteiger und Anwender. SAP Press
- Fix, W., Plota, R. (2021). SAP – Der technische Einstieg: Der Standardtitel für Ausbildung, Studium und Quereinstieg. SAP Press
- SAP SE. (2023). SAP Learning journey “Explore Integrated Business Processes in SAP S/4HANA”.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Career Development

Module Code: DLBKAENT_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum		BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Prof. Dr. Annette Strauß (Personal Career Plan) / Prof. Dr. Heike Schiebeck (Personal Elevator Pitch)

Contributing Courses to Module

- Personal Career Plan (DLBKAENT01_E)
- Personal Elevator Pitch (DLBKAENT02_E)

Module Exam Type

Module Exam	Split Exam
	Personal Career Plan • Study Format "Duales myStudium": Advanced Workbook • Study Format "myStudies": Advanced Workbook • Study Format "Distance Learning": Advanced Workbook Personal Elevator Pitch • Study Format "Duales myStudium": Concept Presentation • Study Format "Distance Learning": Concept Presentation • Study Format "myStudies": Concept Presentation

Weight of Module
see curriculum

Module Contents

Personal Career Plan

- Career Theories and Models
- Career Development
- Choosing Possible Careers
- Personal Branding
- Career Strategy
- Global Careers
- Employment Search

Personal Elevator Pitch

Through the application of self-reflection, self-awareness based on relevant career success parameters students should develop career goals, career stages, and their career strategy. Taking into account their current professional and/or study situation, the central elements of a short-, and medium-term career planning are worked out by the students for their individual case. At the end of the course, students will be able to present their personal elevator pitch and communicate it in a proper way that is appropriate for the target group or audience. In this way, they will reflect on their current professional situation. The personal elevator pitch, being at hear of personal branding, supports the conveyance of this vision during personal networking activities.

Learning Outcomes

Personal Career Plan

On successful completion, students will be able to

- understand, apply, and reflect presented career theory and models with regard to their personal situation to arrive at a concept or pictore of a desired career.
- understand and critically reflect the concept of career and career planning.
- understand the relevance of a strategically oriented career planning.
- understand the importance of and conduct a personal assessment to identify one's personality, values, motivation, strengths, competencies, skills, and interests.
- understand the necessity of building and maintaining their own personal brand.
- understand differing job search processes across national/international contexts, and to create context-sensitive job applications accordingly.
- understand the principles of global careers and how to effectively act in international environments.

Personal Elevator Pitch

On successful completion, students will be able to

- identify their career goals, career stages, and the personal status quo with regard to their achievement.
- reflect their current situation and define where they want to aim.
- develop a career strategy by creating personal career goals and a coherent action plan.
- understand and apply the process of building a personal brand.
- define their identity, skills, profession, reasons to believe and necessary investments.
- identify their personal strengths and their core driver.
- understand the power of effective communication, networking, and storytelling.
- understand the principles and apply the process of designing a strong personal elevator pitch.
- critically reflect and adapt their personal elevator pitch to the specificities of the context, audience, target group, and way of delivery.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Human Resources	All Bachelor Programs in the Human Resources field

Personal Career Plan

Course Code: DLBKAENT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

In today's complex and ever-changing environment, the forms of careers vary depending on the context, understanding of values, and market dynamics. The 'classic career ladder' that one is climbing being the only predominant form of career is long outdated, and individuals are being confronted with a great number of opportunities regarding industry or job choice and working arrangements.Considering the great variety of options especially for well-educated individuals, has become more important than ever to make informed decisions. This course is designed to support students maneauvering themselves through these complexities of their personal career plan, whereby self-awareness, self-reflection, and goal-setting are important elements of this process. Guided by central elements of career theory, career models, and research outcomes, students will be given tools and reflection exercises to arrive at a solid, directly applicable strategy to further steet their professional progress and career steps.

Course Outcomes

On successful completion, students will be able to

- understand, apply, and reflect presented career theory and models with regard to their personal situation to arrive at a concept or pictore of a desired career.
- understand and critically reflect the concept of career and career planning.
- understand the relevance of a strategically oriented career planning.
- understand the importance of and conduct a personal assessment to identify one's personality, values, motivation, strengths, competencies, skills, and interests.
- understand the necessity of building and maintaining their own personal brand.
- understand differing job search processes across national/international contexts, and to create context-sensitive job applications accordingly.
- understand the principles of global careers and how to effectively act in international environments.

Contents

1. Career Theories and Approaches
    - 1.1 Traditional Career Theories and Models
    - 1.2 Protean Career Orientation
    - 1.3 Career Learning Cycle
2. Career Development

2.1 Career Motives
2.2 Career Roles
2.3 Career Performance

3. Career Planning
3.1 Essentials of Career Planning
3.2 The Career Planning Process
3.3 Contingencies of Career Planning

4. Personal Assessment
4.1 Personality
4.2 Values and Motivation
4.3 Competencies, Skills, Strengths, and Fields of Interest

5. Career Choice
5.1 Possible Career Paths
5.2 Forms of Careers
5.3 Employability
5.4 Career Identity

6. Develop a Career Strategy and Manage your Career
6.1 Career Capital
6.2 Career Goals
6.3 Career Success
6.4 Personal Reflection
6.5 Personal Branding

7. Global Careers
7.1 Forms of Global Careers
7.2 Individual Characteristics of Global Leaders
7.3 Role of Interculturality
7.4 Diversity and Inclusion

8. Search for Employment in Germany and Abroad
8.1 Job Search Databases
8.2 Networks and Platforms
8.3 Shaping Resume and Cover Letter
8.4 Written and Video Application
8.5 Selection Procedures

Literature

Compulsory Reading

Further Reading

- Baruch, Y. (2022). Managing Careers and Employability. SAGE.
- Greenhaus, J.H., Callanan, G.A., & Godshalk, V.M. (2018). Career Management for Life (5th edition). College of Business & Public Management Faculty Books.
- Hoeckstra, H. (2011). A career roles model of career development. Journal of Vocational Behavior, 78(2), 159-173.
- Ibarra, H. (2004). Working Identity: Unconventional Strategies for Reinventing Your Career. Harvard Business School Press.
- Kingsley, T. (2022). Personal Branding. Independently published.
- Ng, T.W.H., Eby, L.T., Sorensen, K.L., & Feldman, D.C. (2005). Predictors of objective and subjective career success: A meta-analysis. Personnel psychology, 58(2), 367-408.
- Ng, T.W.H., & Feldman, D.C. (2014). Subjective career success: A meta-analytic review. Journal of Vocational Behavior, 85(2), 169-179.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods

Tutorial Support
- ☑ Course Feed
- ☑ Intensive Live Sessions/Learning Sprint
- ☑ Recorded Live Sessions

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Slides

Exam Preparation
- ☑ Online Tests
- ☑ Guideline

Study Format myStudies

Study Format	**Course Type**
myStudies	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	Advanced Workbook

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed	☑ Course Book	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Personal Elevator Pitch

Course Code: DLBKAENT02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBKAENT01_E

Course Description

The forms of careers vary depending on the context or personal preferences in today's ever-changing, demanding, and complex environment. Changes in the environment, as for example technology, sustainability, and the rise of artificial intelligence, push individuals to take career transitions into their own hands. Personal endeavors to develop one's career through the acquisition of, for instance, new projects, jobs, or employers, require the right strategies to be successful. Contacts through targeted networking and the development of one's own brand play a special role here. Evenly so for individuals starting their careers after having accomplished their education, effective networking is key to career entry and development in these turbulent times. In addition, personal branding is a concept that not only has gained relevance in research but is also widely used in career counseling. Developing and conveying a personal brand is central to this course. Using the personal branding approach during networking activities, individuals can actively contribute to their career success.

Course Outcomes

On successful completion, students will be able to

- identify their career goals, career stages, and the personal status quo with regard to their achievement.
- reflect their current situation and define where they want to aim.
- develop a career strategy by creating personal career goals and a coherent action plan.
- understand and apply the process of building a personal brand.
- define their identity, skills, profession, reasons to believe and necessary investments.
- identify their personal strengths and their core driver.
- understand the power of effective communication, networking, and storytelling.
- understand the principles and apply the process of designing a strong personal elevator pitch.
- critically reflect and adapt their personal elevator pitch to the specificities of the context, audience, target group, and way of delivery.

Contents

- The core element of this course is a personal elevator pitch with the use of a personal branding canvas. The creation of a personal brand is not only relevant for self-employed freelancers or entrepreneurs but is as well helpful for individuals who strive for their own further development on the career ladder within their organization or for those who

are seeking employment. Having understood the characteristics of and reasoning behind personal branding and the underlying process, students will be able to apply this process to their own person and situation.
- Self-awareness being the main 'ingredient' for an effective personal brand, students will be encouraged to go on an intensive self-reflection journey to deepen their understanding of their identity, skills, profession, and reasons to believe for a personal brand, and subsequently, for a personal elevator pitch.
- Being at the heart of and the essence of personal branding, the elevator pitch enables individuals to impactfully present themselves in a nutshell to important individuals and potential employers. Having understood the principles and key success factors characterizing an elevator pitch, students will be able to develop their own one. They will learn to consider aspects like timing, benefit, clear positioning, target audience through an oral form of delivery. In addition, the role of communication, networking and storytelling principles will be highlighted.
- Knowledge of the core elements and success factors of the personal elevator pitch within the framework of the individual career development.

Literature

Compulsory Reading

Further Reading

- Dowling, D. (2009). How to Perfect an Elevator Pitch About Yourself. Harvard Business Review. https://hbr.org/2009/05/how-to-perfect-an-elevator-pit.
- Gorbatov, S., Khapova, S.N., & Lysova, E.I. (2018). Personal branding: Interdisciplinary systematic review and research agenda. Frontiers in psychology, 2238.
- Gorbatov, S., Khapova, S.N., & Lysova, E.I. (2019). Get noticed to get ahead: The impact of personal branding on career success. Frontiers in psychology, 2662.
- Jourdan Jr., Louis F., Deis, M., & Lysova, E.I. (2010). Getting Your Elevator Pitch To The Plate. Business Journal for Entrepreneurs, 2010(1), 43-47.
- Woodside, A.G. (2010). Brand consumer storytelling theory and research: Introduction to a Psychology & Marketing special issue. Psychology & Marketing, 27(6), 531-540.

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Concept Presentation

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Concept Presentation

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Concept Presentation

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

AWS Cloud Specialization

Module Code: DLBAWSCLSP

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Georgi Dimchev (Project: AWS - Cloud Essentials) / Prof. Dr. Tianxiang Lu (Project: AWS - Cloud Advanced)

Contributing Courses to Module

- Project: AWS - Cloud Essentials (DLBPAWSCLES01)
- Project: AWS - Cloud Advanced (DLBPAWSCLAD01)

Module Exam Type

Module Exam	Split Exam
	Project: AWS - Cloud Essentials • Study Format "myStudies": Written Assessment: Project Report • Study Format "Duales myStudium": Written Assessment: Project Report • Study Format "Distance Learning": Written Assessment: Project Report Project: AWS - Cloud Advanced • Study Format "Distance Learning": Written Assessment: Project Report • Study Format "Duales myStudium": Written Assessment: Project Report • Study Format "myStudies": Written Assessment: Project Report

Weight of Module
see curriculum

Module Contents

Project: AWS - Cloud Essentials

Students will learn the foundational concepts and services of Amazon Web Services (AWS), covering its core infrastructure services including computing, storage, and networking through practical experience. Emphasis is placed on practical skills for deploying Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) solutions.

Project: AWS - Cloud Advanced

This course offers advanced understanding of AWS, with a particular emphasis on specialized areas such as Solutions Architecture, Compliance & Security, and AI & Machine Learning. Students will acquire hands-on expertise in these areas, with the goal of enabling them to deploy laaS, Paas, or SaaS workloads using AWS, effectively tackle real-life interdisciplinary challenges, and confidently handle service configurations within the AWS cloud console.

Learning Outcomes

Project: AWS - Cloud Essentials

On successful completion, students will be able to

- understand the core services of AWS including compute, network, databases, and storage, deployment models (on-premises, hybrid, and vpc).
- explain the shared responsibility model, describe the basic global infrastructure and core security services.
- describe the AWS Well-Architected Framework and the basics of AWS Cloud Migration.
- get familiar with the terminology and concepts related to AWS Services, the AWS Management Console, AWS security measures, IAM and AWS networking services.
- apply and manage core service settings within the AWS cloud console effectively.
- assess data storage services in AWS to meet various application needs.
- plan and implement a scenario-based serverless service for small or medium-sized companies.
- configure basic network security using Amazon CloudWatch monitoring features for simple use cases in AWS, ensuring secure cloud operations.
- critically examine the core billing, account management, and pricing models and explain how to use pricing tools to make cost-effective choices for AWS services.

Project: AWS - Cloud Advanced

On successful completion, students will be able to

- understand and articulate the core services provided by AWS within chosen specialization tracks, including Solutions Architect, Compliance & Security, and AI & Machine Learning.
- critically examine the pros and cons of developing and deploying real-world scenarios using AWS IaaS, PaaS, vs. SaaS and public, private or hybrid deployment demonstrating a clear grasp of the necessary service and deployment intricacies.
- manage and configure profound service settings within the AWS cloud console, showing depth in technical proficiency and operational capabilities.
- critically assess, test and monitor the effect of different AWS deployment features, addressing interdisciplinary challenges through the appropriate use of AWS cloud services in realistic use cases.
- assess and critically reflect on AWS-based solutions, considering industry compliance and security requirements, ensuring a robust understanding of the legal and regulatory framework.
- apply and implement machine learning and artificial intelligence concepts using AWS to solve real-world problems, demonstrating innovative thinking and practical application of theoretical knowledge.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
This module is similar to other modules in the field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Project: AWS - Cloud Essentials

Course Code: DLBPAWSCLES01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

Amazon Web Services (AWS) is a comprehensive cloud computing platform provided by Amazon that offers scalable computing power, storage, and various other functionalities to help businesses and individuals deploy applications and manage data efficiently. It reduces the need for physical hardware, thus lowering costs and increasing flexibility by allowing users to access services and resources on-demand from anywhere in the world. This service is highly relevant for daily life and business as it supports a wide range of applications and services, from hosting websites to supporting IoT devices and big data analytics, ultimately facilitating innovation, scalability, and global operations.This course prepares students for the AWS Cloud Practitioner Certificate, providing a foundational understanding of AWS core services. Students will learn to articulate the benefits and use cases of AWS IaaS, PaaS, and SaaS, and grasp the basics of public, private, and hybrid cloud deployments. The course emphasizes practical skills in managing and configuring AWS services, ensuring students can effectively navigate the AWS cloud console. It lays the groundwork for critical assessments of AWS deployment features, addressing compliance and security requirements, and preparing students for more advanced AWS certifications and applications

Course Outcomes

On successful completion, students will be able to

- understand the core services of AWS including compute, network, databases, and storage, deployment models (on-premises, hybrid, and vpc).
- explain the shared responsibility model, describe the basic global infrastructure and core security services.
- describe the AWS Well-Architected Framework and the basics of AWS Cloud Migration.
- get familiar with the terminology and concepts related to AWS Services, the AWS Management Console, AWS security measures, IAM and AWS networking services.
- apply and manage core service settings within the AWS cloud console effectively.
- assess data storage services in AWS to meet various application needs.
- plan and implement a scenario-based serverless service for small or medium-sized companies.
- configure basic network security using Amazon CloudWatch monitoring features for simple use cases in AWS, ensuring secure cloud operations.
- critically examine the core billing, account management, and pricing models and explain how to use pricing tools to make cost-effective choices for AWS services.

Contents

- This course offers a comprehensive exploration of Amazon Web Services (AWS), focusing on its core services such as computing, networking, databases, and storage solutions. Students will delve into the AWS shared responsibility model, understand the global infrastructure, and learn about the integral security services provided. This also covers the AWS Well-Architected Framework and an introduction of the fundamentals for cloud migration strategies. Through hands-on exercises, students will gain proficiency in managing AWS environments using the AWS Management Console and implement security measures via AWS Identity and Access Management (IAM) and network services. Additionally, the course emphasizes the importance of cost management, enabling students to critically analyze AWS pricing models to make informed financial decisions for cloud-based solutions.

Literature

Compulsory Reading

Further Reading

- AWS Training and Certification Skill Builder. (2024). AWS Cloud Practitioner Essentials (7 hours).
- AWS Training and Certification Skill Builder. (2024). AWS Cloud Quest: Cloud Practitioner.
- AWS Training and Certification Skill Builder. (2024). AWS Technical Essentials (4 hours).
- AWS Training and Certification Skill Builder. (2024). Serverless – Knowledge Badge Readiness Path (13 hours).
- AWS Training and Certification Skill Builder. (2024). Standard Exam Prep Plan: AWS Certified Cloud Practitioner (CLF-C02) (18 hours).

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Project: AWS - Cloud Advanced

Course Code: DLBPAWSCLAD01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	none

Course Description

AWS (Amazon Web Services) is a comprehensive cloud computing platform provided by Amazon that offers scalable computing power, storage, and various other functionalities to help businesses and individuals deploy applications and manage data efficiently. It reduces the need for physical hardware, thus lowering costs and increasing flexibility by allowing users to access services and resources on-demand from anywhere in the world. This service is highly relevant for daily life and business as it supports a wide range of applications and services, from hosting websites to supporting IoT devices, big data analytics and machine learning, ultimately facilitating innovation, scalability, and global operations. The course prepares students for the AWS Cloud Solution Architect Professional Certificate. It dives deeper into AWS core services, focusing on sophisticated deployment and management techniques. Students will critically examine and apply real-world scenarios using AWS IaaS, PaaS, and SaaS, and navigate complex deployment models. They will gain technical proficiency in managing advanced service settings within the AWS cloud console and address interdisciplinary challenges through hands-on practice. Additionally, the course covers assessing AWS solutions for compliance and security, ensuring robust understanding of legal frameworks. Students will also implement machine learning and AI concepts to solve real-world problems, fostering innovative thinking and practical application, and preparing them for the dynamic demands of the tech industry.

Course Outcomes

On successful completion, students will be able to

- understand and articulate the core services provided by AWS within chosen specialization tracks, including Solutions Architect, Compliance & Security, and AI & Machine Learning.
- critically examine the pros and cons of developing and deploying real-world scenarios using AWS IaaS, PaaS, vs. SaaS and public, private or hybrid deployment demonstrating a clear grasp of the necessary service and deployment intricacies.
- manage and configure profound service settings within the AWS cloud console, showing depth in technical proficiency and operational capabilities.
- critically assess, test and monitor the effect of different AWS deployment features, addressing interdisciplinary challenges through the appropriate use of AWS cloud services in realistic use cases.
- assess and critically reflect on AWS-based solutions, considering industry compliance and security requirements, ensuring a robust understanding of the legal and regulatory framework.
- apply and implement machine learning and artificial intelligence concepts using AWS to solve real-world problems, demonstrating innovative thinking and practical application of theoretical knowledge.

Contents

- This course ensures students gain a comprehensive understanding of AWS, specializing in Solutions Architect, Compliance & Security, and AI & Machine Learning. They will articulate core AWS services and critically examine the pros and cons of deploying real-world scenarios using AWS IaaS, PaaS, SaaS, and different deployment models (public, private, hybrid).
- Students will manage and configure service settings within the AWS cloud console, demonstrating technical proficiency. They will assess, test, and monitor AWS deployment features, addressing interdisciplinary challenges using realistic use cases. Additionally, students will evaluate AWS-based solutions for industry compliance and security, understanding the legal and regulatory frameworks.
- The course also covers applying machine learning and AI concepts using AWS to solve real-world problems, encouraging innovative thinking and practical application. This approach prepares students to excel in cloud architecture, compliance protocols, security measures, and AI-driven problem-solving, ensuring readiness for the tech industry's dynamic demands.

Literature
Compulsory Reading
Further Reading ▪ AWS Training and Certification Skill Builder. (2024). AWS Solutions Architect – Knowledge Badge Readiness Path (51 hours). ▪ AWS Training and Certification Skill Builder. (2024). Generative AI Learning Plan for Developers (12 hours). ▪ AWS Training and Certification Skill Builder. (2024). Online Course Supplement: Practical Data Science with Amazon SageMaker (1 day).

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Duales myStudium

Study Format	Course Type
Duales myStudium	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format myStudies

Study Format	Course Type
myStudies	Project

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods		
Tutorial Support	**Learning Material**	**Exam Preparation**
☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Bachelor Thesis

Module Code: DLBBT

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	300 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Degree Program Advisor (SGL) (Bachelor Thesis) / Degree Program Advisor (SGL) (Colloquium)

Contributing Courses to Module

- Bachelor Thesis (DLBBT01)
- Colloquium (DLBBT02)

Module Exam Type

Module Exam

Split Exam

Bachelor Thesis

- Study Format "myStudies": Bachelor Thesis
- Study Format "Distance Learning": Bachelor Thesis

Colloquium

- Study Format "myStudies": Colloquium
- Study Format "Distance Learning": Colloquium

Weight of Module

see curriculum

Module Contents

Bachelor Thesis

- Bachelor's thesis
- Colloquium on the bachelor's thesis

Colloquium

Learning Outcomes

Bachelor Thesis

On successful completion, students will be able to

- work on a problem from their major field of study by applying the specialist and methodological skills they have acquired during their studies.
- independently analyze selected tasks with scientific methods, critically evaluate them, and develop appropriate solutions under the guidance of an academic supervisor.
- record and analyze existing (research) literature appropriate to the topic of their bachelor's thesis.
- prepare a detailed written elaboration in compliance with scientific methods.

Colloquium

On successful completion, students will be able to

- present a problem from their field of study using academic presentation and communication techniques.
- reflect on the scientific and methodological approach chosen in their bachelor's thesis.
- demonstrate that they can actively answer subject-related questions from the subject experts (reviewers of the bachelor’s thesis).

Links to other Modules within the Study Program	**Links to other Study Programs of the University**
All modules in the Bachelor program	All Bachelor Programs in distance learning

Bachelor Thesis

Course Code: DLBBT01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		9	none

Course Description

The aim and purpose of the bachelor's thesis is to successfully apply the subject-specific and methodological competencies acquired during the course of study in the form of an academic dissertation with a thematic reference to the major field of study. The content of the bachelor's thesis can be a practical-empirical or theoretical-scientific problem. Students should prove that they can independently analyze a selected problem with scientific methods, critically evaluate it, and work out proposed solutions under the subject-methodological guidance of an academic supervisor. The topic chosen by the student from their respective field of study should meet the acquired scientific competences, deepening their academic knowledge and skills in order to meet the future needs of the field.

Course Outcomes

On successful completion, students will be able to

- work on a problem from their major field of study by applying the specialist and methodological skills they have acquired during their studies.
- independently analyze selected tasks with scientific methods, critically evaluate them, and develop appropriate solutions under the guidance of an academic supervisor.
- record and analyze existing (research) literature appropriate to the topic of their bachelor's thesis.
- prepare a detailed written elaboration in compliance with scientific methods.

Contents

- The bachelor's thesis must be written on a topic that relates to the content of the respective major field of study. In the context of the bachelor's thesis, the problem, as well as the scientific research goal, must be clearly emphasized. The work must reflect the current state of knowledge of the topic to be examined by means of an appropriate literature analysis. The student must prove their ability to use the acquired knowledge theoretically and/or empirically in the form of an independent and problem-solution-oriented application.

Literature
Compulsory Reading
Further Reading ▪ Lipson, C. (2018). How to write a BA thesis. A practical guide from your first ideas to your finished paper (2nd ed.). University of Chicago Press. ▪ Turabian, K. L. (2013). A Manual for Writers of Research Papers, theses, and dissertations (8th ed.). University of Chicago Press. ▪ Selection of literature according to topic

Study Format myStudies

Study Format	Course Type
myStudies	Thesis Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Bachelor Thesis

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
270 h	0 h	0 h	0 h	0 h	270 h

Instructional Methods

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Bachelor Thesis

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
270 h	0 h	0 h	0 h	0 h	270 h

Instructional Methods

Colloquium

Course Code: DLBBT02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		1	none

Course Description

The colloquium will take place after the submission of the bachelor's thesis. This is done at the invitation of the experts. During the colloquium, students must prove that they have independently produced the content and results of the written work. The content of the colloquium is a presentation of the most important work contents and research results by the student as well as the answering of questions by experts.

Course Outcomes

On successful completion, students will be able to

- present a problem from their field of study using academic presentation and communication techniques.
- reflect on the scientific and methodological approach chosen in their bachelor's thesis.
- demonstrate that they can actively answer subject-related questions from the subject experts (reviewers of the bachelor's thesis).

Contents

- The colloquium includes a presentation of the most important results of the bachelor's thesis, followed by the student answering the reviewers' technical questions.

Literature

Compulsory Reading

Further Reading

- Subject specific literature chosen by the student

Study Format myStudies

Study Format	Course Type
myStudies	Thesis Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Colloquium

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
30 h	0 h	0 h	0 h	0 h	30 h

Instructional Methods

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Colloquium

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
30 h	0 h	0 h	0 h	0 h	30 h

Instructional Methods