MODULE HANDBOOK

Bachelor of Science

Bachelor Software Development (FS-OI-BASD-01)

180 CP

Distance Learning

As of December 4th, 2024

INTERNATIONAL
UNIVERSITY OF
APPLIED SCIENCES

Classification: Consecutive

Contents

1. Semester

Module IGIS-01_E: Software Engineering Principles
Module Description 13
Course IGIS01-01_E: Software Engineering Principles 15

Module DLBCSIAW: Introduction to Academic Work
Module Description 18
Course DLBCSIAW01: Introduction to Academic Work 20

Module DLBCSRE: Requirements Engineering
Module Description 25
Course DLBCSRE01: Requirements Engineering 27

Module DLBDSIPWP: Introduction to Programming with Python
Module Description 32
Course DLBDSIPWP01: Introduction to Programming with Python 34

Module DLBFTPPP_E: Project: Programming with Python
Module Description 38
Course DLBFTPPP01_E: Project: Programming with Python 40

2. Semester

Module DLBCSWAD: Web Application Development
Module Description 44
Course DLBCSWAD01: Web Application Development 46

Module DLBCSOOPJ: Object-oriented Programming with Java
Module Description 50
Course DLBCSOOPJ01: Object-oriented Programming with Java 52

Module DLBCSDMDS: Database Modeling and Database Systems
Module Description 57
Course DLBCSDMDS01: Database Modeling and Database Systems 59

Module DLBCSS: Specification
Module Description 63
Course DLBCSS01: Specification 65

Module DLBITPEWP_E: Project: Getting started in Web Programming
Module Description 69
Course DLBITPEWP01_E: Project: Getting started in Web Programming 71

---

3. Semester

Module DLBCSL-02: Algorithms, Data Structures, and Programming Languages
Module Description 75
Course DLBCSL01-02: Algorithms, Data Structures, and Programming Languages 77

Module DLBSEPDOCD_E: DevOps and Continuous Delivery
Module Description 81
Course DLBSEPDOCD01_E: DevOps and Continuous Delivery 83

Module DLBSESA_E: Software Architecture
Module Description 86
Course DLBSESA01_E: Software Architecture 88

Module DLBCSSQA: Software Quality Assurance
Module Description 92
Course DLBCSSQA01: Software Quality Assurance 94

Module DLBMINPAPCC_E: Project: General Programming with C/C++
Module Description 99
Course DLBMINPAPCC01_E: Project: General Programming with C/C++ 101

---

4. Semester

Module DLBSEPENIT_E: Ethics and Sustainability in IT
Module Description 105
Course DLBSEPENIT01_E: Ethics and Sustainability in IT 107

Module IWNF1_E: Techniques and methods for agile software development
Module Description 112
Course IWNF01_E: Techniques and methods for agile software development 114

Module DLBCSEMSE1-01: Mobile Software Engineering
Module Description 118
Course DLBCSEMSE01-01: Mobile Software Engineering 120

Module ISSE_E: Seminar: Software Engineering
Module Description 123
Course ISSE01_E: Seminar: Software Engineering 125

Module DLBCSPSE: Project: Software Engineering
Module Description 128
Course DLBCSPSE01: Project: Software Engineering 130

---

5. Semester

Module DLBCSIDPITS: Introduction to Data Protection and Cyber Security
Module Description 134
Course DLBCSIDPITS01: Introduction to Data Protection and Cyber Security 136

Module DLBDSCC: Cloud Computing
Module Description 140
Course DLBDSCC01: Cloud Computing 142

Module DLBMIAMVR_E: Augmented, Mixed and Virtual Reality
Module Description 146
Course DLBMIAMVR01_E: Augmented, Mixed and Virtual Reality 148
Course DLBMIAMVR02_E: X-Reality Project 154

Module DLBMIAMVR2_E: X-Reality Project
Module Description 159
Course DLBMIAMVR02_E: X-Reality Project 161

Module DLBKDDSV-02_E: Design Basics: Seeing and Understanding
Module Description 166
Course DLBKDDSV01-02_E: Design Basics: Seeing and Understanding 168

Module DLBMIUEX1_E: User Experience
Module Description 171
Course DLBMIUEX01_E: User Experience 173

Module DLBCSCT-01: Cryptography
Module Description 178
Course DLBCSCT01-01: Cryptography 180

Module DLBCSM1: Mathematics I
Module Description 185
Course DLBCSM101: Mathematics I 187

Module DLBAETDIT_E: Digital and Information Technology
Module Description 191
Course DLBAETDIT01_E: Digital and Information Technology 193

Module DLBINGEIT_E: Introduction to the Internet of Things

Module Description 197
Course DLBINGEIT01_E: Introduction to the Internet of Things 199

Module DLBDSIDS-01: Introduction to Data Science
Module Description 203
Course DLBDSIDS01-01: Introduction to Data Science 205

Module DLBDBDL_E: Deep Learning
Module Description 209
Course DLBDBDL01_E: Deep Learning 211

Module DLBCSEBI1: Business Intelligence
Module Description 216
Course DLBCSEBI01: Business Intelligence 218

Module DLBDSOOFPP: Project: Object Oriented and Functional Programming with Python
Module Description 222
Course DLBDSOOFPP01: Project: Object Oriented and Functional Programming in Python 224

Module DLBDSEAIS1: Artificial Intelligence
Module Description 228
Course DLBDSEAIS01: Artificial Intelligence 230

Module DLBBAB_E: Business 101
Module Description 235
Course DLBBAB01_E: Business 101 237

Module DLBUXEUR_E: Introduction to User Research
Module Description 241
Course DLBUXEUR01_E: Introduction to User Research 243

Module DLBMIUID1_E: User Interface Design and Ergonomics
Module Description 247
Course DLBMIUID01_E: User Interface Design and Ergonomics 249

Module DLBSEPITI_E: IT Infrastructure
Module Description 252
Course DLBSEPITI01_E: IT Infrastructure 254

Module DLBAVRECC_E: Introduction to Computer Graphics
Module Description 257
Course DLBAVRECC01_E: Introduction to Computer Graphics 259

Module DLBAVRSEGAXR_E: Seminar: Ethical and Social Aspects of XR
Module Description 262

Course DLBAVRSEGAXR01_E: Seminar: Ethical and Social Aspects of XR 264

Module DLBUXUXP_E: UX Prototyping
Module Description 268
Course DLBUXUXP01_E: UX Prototyping 270

Module DLBPAWSCLES: Project: AWS - Cloud Essentials
Module Description 274
Course DLBPAWSCLES01: Project: AWS - Cloud Essentials 276

Module DLBPAWSCLAD: Project: AWS - Cloud Advanced
Module Description 281
Course DLBPAWSCLAD01: Project: AWS - Cloud Advanced 283

Module DLBCSESPB_E: System Pentesting Basics
Module Description 289
Course DLBCSESPB01_E: System Pentesting Basics 291

Module DLBCSEEFT1_E: Threat Modeling
Module Description 296
Course DLBCSEEFT01_E: Threat Modeling 298

Module DLBROIR_E: Introduction to Robotics
Module Description 302
Course DLBROIR01_E: Introduction to Robotics 304

Module DLBROES_E: Embedded Systems
Module Description 308
Course DLBROES01_E: Embedded Systems 310

Module DLBDBSC_E: Statistical Computing
Module Description 314
Course DLBDBSC01_E: Statistical Computing 316

Module DLBDSEDAV: Exploratory Data Analysis and Visualization
Module Description 320
Course DLBDSEDAV01: Exploratory Data Analysis and Visualization 322

Module DLBBANDUE: Data Management and ETL
Module Description 326
Course DLBBANDUE01: Data Management and ETL 328

Module DLBCSEBI2: Project: Business Intelligence
Module Description 331
Course DLBCSEBI02: Project: Business Intelligence 333

Module DLBAIINLP: Introduction to NLP
Module Description 336
Course DLBAIINLP01: Introduction to NLP 338

Module DLBAIPNLP : Project: NLP
Module Description 342
Course DLBAIPNLP01: Project: NLP 344

Module DLBDBCM_E: Change Management
Module Description 347
Course DLBDBCM01_E: Change Management 349

Module DLBWIPDTIT_E: Project: Design Thinking for IT
Module Description 353
Course DLBWIPDTIT01_E: Project: Design Thinking for IT 355

Module DLBSEPCP_E: Project: Cloud Programming
Module Description 359
Course DLBSEPCP01_E: Project: Cloud Programming 361

---

6. Semester

Module DLBCSDSJCL: Data Structures and Java Class Library
Module Description 366
Course DLBCSDSJCL01: Data Structures and Java Class Library 368

Module DLBITOWAWBI-01_E: Programming of Web Applications - Web-based Business Information Systems
Module Description 372
Course DLBITOWAWBI01-01: Programmierung von Web-Anwendungen - webbasierte betriebliche Informationssysteme 374

Module DLBAVROOPC_E: Object-oriented Programming with C#
Module Description 379
Course DLBAVROOPC01_E: Object-oriented Programming with C# 381

Module DLBAVRAEU_E: Application Development with Unity
Module Description 386
Course DLBAVRAEU01_E: Application Development with Unity 388

Module DLBMDMMD-01_E: Mobile App Design
Module Description 392
Course DLBMDMMD01-01_E: Mobile App Design 394

Module DLBKDPAPPD_E: Project: Application Design
Module Description 398
Course DLBKDPAPPD01_E: Project: Application Design 400

Module DLBCSEDCSW_E: DevSecOps and Common Software Weaknesses
Module Description 403
Course DLBCSEDCSW01_E: DevSecOps and Common Software Weaknesses 405

Module DLBCSEEDSO1_E: Project: Agile DevSecOps Software Engineering
Module Description 410
Course DLBCSEEDSO01_E: Project: Agile DevSecOps Software Engineering 412

Module DLBROST_E: Sensor Technology
Module Description 416
Course DLBROST01_E: Sensor Technology 418

Module DLBAETWST2_E: Project: Sensors and Actors
Module Description 423
Course DLBAETWST02_E: Project: Sensors and Actors 425

Module DLBDSCC: Cloud Computing
Module Description 428
Course DLBDSCC01: Cloud Computing 430

Module DLBPDWDDAIT2_E: Project: Design for the Internet of Things
Module Description 434
Course DLBPDWDDAIT02_E: Project: Design for the Internet of Things 436

Module DLBDSEDA1: Advanced Data Analysis
Module Description 439
Course DLBDSEDA01: Advanced Data Analysis 441

Module DLBDSEDA2: Project: Data Analysis
Module Description 445
Course DLBDSEDA02: Project: Data Analysis 447

Module DLBDSEDE1: Data Engineering
Module Description 450
Course DLBDSEDE01: Data Engineering 452

Module DLBDSEDE2: Project: Data Engineering
Module Description 456
Course DLBDSEDE02: Project: Data Engineering 458

Module DLBPKIEKPT1_E : Project: AI Excellence with Creative Prompting Techniques

Module Description 460
Course DLBPKIEKPT01_E: Project: AI Excellence with Creative Prompting Techniques 462

Module DLBFMPGKIU_E: Project: Generative AI in an Enterprise Context
Module Description 467
Course DLBFMPGKIU01_E: Project: Generative AI in an Enterprise Context 469

Module DLBKPSGUV_E: Negotiation Techniques
Module Description 473
Course DLBKPSGUV01_E: Negotiation Techniques 475

Module DLBBWOB_E: Organizational Behavior
Module Description 479
Course DLBBWOB01_E: Organizational Behavior 481

Module DLBSG1_E: Studium Generale I
Module Description 485
Course DLBSG01_E: Studium Generale I 487

Module DLBSG2_E: Studium Generale II
Module Description 490
Course DLBSG02_E: Studium Generale II 492

Module DLBSEPPSD-01_E: Project: Software Development with AI
Module Description 495
Course DLBSEPPSD01-01_E: Project: Software Development with AI 497

Module DLBITPIWI_E: Internship: Computer Science & Business Information Systems
Module Description 500
Course DLBITPIWI01_E: Internship: Computer Science & Business Information Systems 502

Module DLBCSIDM: Intercultural and Ethical Decision-Making
Module Description 506
Course DLBCSIDM01: Intercultural and Ethical Decision-Making 508

Module DLBCSCW: Collaborative Work
Module Description 513
Course DLBCSCW01: Collaborative Work 515

Module DLBCSCSAS: Computer Science and Society
Module Description 521
Course DLBCSCSAS01: Computer Science and Society 523

Module DLBLODB_E: Digital Business Models
Module Description 527

Course DLBLODB01_E: Digital Business Models 529

Module DLBCSEITPAM1: IT Project Management
Module Description 533
Course DLBCSEITPAM01: IT Project Management 535

Module DLBCCOEDAH: Project: Digitalization and Automation Hackathon
Module Description 539
Course DLBCCOEDAH01: Project: Digitalization and Automation Hackathon 541

Module DLBBT: Bachelor Thesis
Module Description 546
Course DLBBT01: Bachelor Thesis 548
Course DLBBT02: Colloquium 552

1. Semester

Software Engineering Principles

Module Code: IGIS-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

Prof. Dr. Markus Kleffmann (Software Engineering Principles)

Contributing Courses to Module

- Software Engineering Principles (IGIS01-01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Risks and challenges of Software Engineering
- Software Lifecycle
- Roles, Phases, Activites in Software Engineering
- Process Models

Learning Outcomes

Software Engineering Principles

On successful completion, students will be able to

- explain the challenges in the development of complex IT systems.
- differentiate between fundamental phases in the software lifecycle.
- understand core software development activities, from requirements engineering to commissioning.
- differentiate the roles involved in a software development process.
- understand basic concepts and methods for organizing software development projects.
- know different agile and plan-driven process models of software 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 fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Software Engineering Principles

Course Code: IGIS01-01_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 provide students with an insight into the technical and theoretical To teach the basics of software engineering. Based on the typical challenges in the development of complex IT systems, students are taught methods and concepts that can be used to address these risks in practice. In addition to the phases and activities of a software product life cycle, this also includes the process roles active there. The course concludes with an overview of practice-established agile and plan-driven approaches to software development.

Course Outcomes

On successful completion, students will be able to

- explain the challenges in the development of complex IT systems.
- differentiate between fundamental phases in the software lifecycle.
- understand core software development activities, from requirements engineering to commissioning.
- differentiate the roles involved in a software development process.
- understand basic concepts and methods for organizing software development projects.
- know different agile and plan-driven process models of software development.

Contents

1. Risks and challenges of enterprise software engineering
   - 1.1 Properties of enterprise software systems
   - 1.2 Software Engineering
   - 1.3 Risks and typical problems
   - 1.4 Root cause analysis
   - 1.5 Challenges in Software Engineering
2. Software life cycle: from planning to replacement
   - 2.1 The software life cycle at a glance
   - 2.2 Planning
   - 2.3 Development
   - 2.4 Operation
   - 2.5 Maintenance

2.6 Shutdown

3. Requirements engineering and specification
   - 3.1 requirements engineering
   - 3.2 Specification

4. Architecture and implementation
   - 4.1 Architecture
   - 4.2 Implementation

5. Testing, operation and evolution
   - 5.1 Testing
   - 5.2 Operation
   - 5.3 Evolution

6. Roles in Software Engineering
   - 6.1 Idea of the role-based approach
   - 6.2 Typical roles

7. Organization of software projects
   - 7.1 From process paradigm towards software process
   - 7.2 Process Paradigms

8. Software Process Model Frameworks
   - 8.1 V-Model XT
   - 8.2 Scrum and Kanban
   - 8.3 Scalable Agility
   - 8.4 Hybrid Processes

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 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	

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	**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	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
☑ 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	

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

Dr. Cosmina Croitoru (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: Programming with Python

Module Code: DLBFTPPP_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. Gabriele Bleser-Taetz (Project: Programming with Python)

Contributing Courses to Module

- Project: Programming with Python (DLBFTPPP01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

This module deals with the application of basic Python Programming in the field of finance.

Learning Outcomes

Project: Programming with Python

On successful completion, students will be able to

- acquire financial data with the help of an API.
- perform basic data preparation and analysis with the Pandas and NumPy libraries.
- calculate and present basic key figures on the return and risk of a share.
- independently create suitable data visualizations.
- present analysis results and visualizations in a Jupyter notebook.

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: Programming with Python

Course Code: DLBFTPPP01_E

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

Course Description

Python is by far the most widely used programming language in industry and research. In finance, the quantitative analysis of a stock is often the first step in many investment decisions. This course focuses on the application of basic Python programming in the context of quantitative stock analysis.

Course Outcomes

On successful completion, students will be able to

- acquire financial data with the help of an API.
- perform basic data preparation and analysis with the Pandas and NumPy libraries.
- calculate and present basic key figures on the return and risk of a share.
- independently create suitable data visualizations.
- present analysis results and visualizations in a Jupyter notebook.

Contents

- This course provides a quantitative analysis of a share listed on a stock exchange (e.g., Apple). The analysis is carried out in an interactive Jupyter notebook. With the help of an API (e.g., Nasdaq Data Link), price and return time series for the selected stock are loaded and analyzed using the pandas and NumPy libraries. Basic calculations for the return and risk of the share are displayed, and price time series and key figures are visualized using suitable methods.

Literature
Compulsory Reading
Further Reading ▪ Lewinson, E. (2020). Python for finance cookbook: Over 50 recipes for applying modern Python libraries to financial data analysis. Packt Publishing Limited. ▪ Martelli, A., Ravenscroft, A. M., Holden, S., & McGuire, P. (2023). Python in a nutshell: A desktop quick reference [electronic resource]. O'Reilly. ▪ VanderPlas, J. (2023). Python data science handbook: Essential tools for working with data [electronic resource]. O'Reilly. ▪ Walker, M. (2024). Python data cleaning cookbook: Prepare your data for analysis with pandas, NumPy, Matplotlib, scikit-learn, and OpenAI. Packt Publishing Limited.

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

2. Semester

Web Application Development

Module Code: DLBCSWAD

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBCSOOPJ01, DLBCSDSJCL01	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 Werning (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	DLBCSOOPJ01, DLBCSDSJCL01

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	

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. Damir Ismailovic (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(s) of Computer Science & Software Development.	All Bachelor Programmes in the IT & Technology field(s).

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
	☑ 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	

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	

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	

Project: Getting started in Web Programming

Module Code: DLBITPEWP_E

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

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

Module Coordinator

Prof. Dr. Jurek Breuninger (Project: Getting started in Web Programming)

Contributing Courses to Module

- Project: Getting started in Web Programming (DLBITPEWP01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

Students gain a comprehensive foundation in web programming. They cover both client-side and server-side programming, the structure and function of web technologies, and the development and testing of web applications.

Learning Outcomes

Project: Getting started in Web Programming

On successful completion, students will be able to

- develop full-stack web applications using HTML, CSS, Java, CGI, and databases.
- grasp the basics of client-side web programming and apply techniques such as JavaScript, DOM, AJAX, and JSON.
- follow the web application development process, including tools, design principles, and security considerations.
- select web technologies judiciously and use them appropriately to accomplish well-defined tasks in information system architecture.
- make instructive observations and gain experience in action.
- especially in the dual distance learning program: Apply the knowledge acquired in the course to practical problems and expand it through practical experience in the company.

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: Getting started in Web Programming

Course Code: DLBITPEWP01_E

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

Course Description

Students will develop a comprehensive overview of the world of web programming. From understanding the history of the internet and its structure to developing their own web applications, students will have the opportunity to gain a wide range of skills and competencies. The course will cover key aspects of web programming including internet protocols, HTML, CSS, Java, CGI, PHP and client-side technologies such as JavaScript and AJAX. In addition, students will also explore the process of web application development, including approaches to testing and web application testing and the tools and environments required for development. Special in the dual distance learning program: In the dual distance learning program, the theory-practice transfer is to be achieved by means of a real project that is to be implemented in practice. As part of the practical project, students work on a practice-relevant question from their practical company under the supervision of a teacher. Supervision from the practice partner can be provided on request.

Course Outcomes

On successful completion, students will be able to

- develop full-stack web applications using HTML, CSS, Java, CGI, and databases.
- grasp the basics of client-side web programming and apply techniques such as JavaScript, DOM, AJAX, and JSON.
- follow the web application development process, including tools, design principles, and security considerations.
- select web technologies judiciously and use them appropriately to accomplish well-defined tasks in information system architecture.
- make instructive observations and gain experience in action.
- especially in the dual distance learning program: Apply the knowledge acquired in the course to practical problems and expand it through practical experience in the company.

Contents

- Students will gain knowledge about the different dimensions of web programming, starting with a basic understanding of the Internet and its structure. They will learn how to use HTML, CSS, and XHTML to create static websites. Server-side programming is covered through the introduction of Java and CGI, as well as database connections. Students will learn the structure of PHP and its integration into HTML, including control structures, functions, and handling forms in PHP. Client-side programming is also covered, and students will learn

how to use JavaScript, DOM, AJAX, and JSON, and how these technologies are utilized in web programming. Finally, the development process of web applications is explored, including methods for testing web applications, basic development tools and environments, design concepts, and security considerations.

Literature

Compulsory Reading

Further Reading

- Ackermann, P. (2024). Full stack web development: Mastering web development from client to server-side technologies. Packt Publishing.
- Connolly, R., & Hoar, R. (2021). Fundamentals of web development (3rd ed.). Pearson.
- DuRocher, D. (2021). HTML & CSS quickstart guide: The simplified beginner's guide to developing a strong coding foundation, building responsive websites, and mastering the fundamentals of modern web design. ClydeBank Media LLC.
- McFedries, P. (2024). Web coding & development all-in-one for dummies. For Dummies.
- Svekis, L. L., van Putten, M., & Codestars By Rob Percival. (2021). JavaScript from beginner to professional: Learn JavaScript quickly by building fun, interactive, and dynamic web apps, games, and pages. 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	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

3. Semester

Algorithms, Data Structures, and Programming Languages

Module Code: DLBCSL-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

(Algorithms, Data Structures, and Programming Languages)

Contributing Courses to Module

- Algorithms, Data Structures, and Programming Languages (DLBCSL01-02)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Case Study	

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: DLBCSL01-02

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 Distance Learning

Study Format	Course Type
Distance Learning	Theory Course

Information about the examination	
Examination Admission Requirements	**Online Tests:** yes
Type of Exam	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	☑ Practice Exam
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

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. Service 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	
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Software Architecture

Module Code: DLBSESA_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	(DLBDSOOFPP01or DLBCSOOPJ01) and (DLBCSRE01or DLBCSS01) and DLBCSDMDS01	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

(Software Architecture)

Contributing Courses to Module

- Software Architecture (DLBSESA01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Software Architecture Principles, Styles, and Patterns for software architectures
- Operating System Architectures
- Distributed Systems and Middleware Technologies
- Data Management and Databases
- Quality Criteria and Non-functional Requirements
- Tools and Technologies

Learning Outcomes

Software Architecture

On successful completion, students will be able to

- recognize and apply basic principles, styles and patterns in software architectures.
- differentiate between different operating system architectures and evaluate the influence of the operating system architecture on the software architecture.
- select suitable middleware technologies for a distributed system and evaluate the influence of this technology on the software architecture.
- select suitable databases for a software architecture and evaluate the influence of the database technology on the software architecture.
- select suitable technologies and make architectural decisions based on quality criteria and non-functional requirements.
- document software architectures using standards and modeling tools.

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 Architecture

Course Code: DLBSESA01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	(DLBDSOOFPP01or DLBCSOOPJ01) and (DLBCSRE01or DLBCSS01) and DLBCSDMDS01

Course Description

The design and analysis of software architectures is a central aspect of software development. It significantly influences the quality, performance and modifiability of software systems. In the course, students acquire knowledge of the basic principles, styles and patterns of software architectures and learn what influence operating system architectures, middleware technologies and database technologies have on software architectures. Students then learn how to incorporate quality criteria and non-functional requirements into their architectural decisions. Finally, techniques for the effective documentation of software architectures using standards and modeling tools are taught. This enables students to make and justify well-founded architectural decisions.

Course Outcomes

On successful completion, students will be able to

- recognize and apply basic principles, styles and patterns in software architectures.
- differentiate between different operating system architectures and evaluate the influence of the operating system architecture on the software architecture.
- select suitable middleware technologies for a distributed system and evaluate the influence of this technology on the software architecture.
- select suitable databases for a software architecture and evaluate the influence of the database technology on the software architecture.
- select suitable technologies and make architectural decisions based on quality criteria and non-functional requirements.
- document software architectures using standards and modeling tools.

Contents

1. Software Architecture Principles, Styles, and Patterns
    - 1.1 Importance and Role of Software Architecture
    - 1.2 Design Principles
    - 1.3 Architectural Styles
    - 1.4 Architectural Patterns
    - 1.5 Essential Design Patterns

2. Operating System Architectures
   - 2.1 Monolithic Architectures
   - 2.2 Microkernel Architectures
   - 2.3 Hybrid Kernel Architectures
   - 2.4 Basic Operating System Functions
   - 2.5 Influence of the Operating System Architecture on the Software Architecture

3. Distributed Systems and Middleware Technologies
   - 3.1 Challenges of Distributed Systems
   - 3.2 Communication Mechanisms
   - 3.3 Middleware Technologies
   - 3.4 Influence of Middleware Technology on the Software Architecture

4. Data Management and Databases
   - 4.1 Evolution of Data Management Concepts
   - 4.2 Relational Databases
   - 4.3 Non-relational Databases
   - 4.4 Influence of Database Technology on Software Architecture

5. Quality Criteria and Non-functional Requirements
   - 5.1 Operating System-related
   - 5.2 For Middleware and Distributed Systems
   - 5.3 For Databases
   - 5.4 Technical Debt and Maintainability
   - 5.5 Trade-offs and Compromises

6. Tools and Technologies
   - 6.1 Documentation Techniques
   - 6.2 Modeling Tools
   - 6.3 Architectures and Programming Languages

Literature
Compulsory Reading
Further Reading ▪ Ciceri, C., Farley, D., Ford, N., Harmel-Law, A., Keeling, M., Lilienthal, C., Rosa, J., Von Zitzewitz, A., Weiss, R., & Woods, E. (2022). Software architecture metrics. O'Reilly Media. ▪ Evans, E. (2003). Domain-driven design: Tackling complexity in the heart of software. Addison-Wesley Longman Publishing Co., Inc. http://dl.acm.org/citation.cfm?id=861502&dl=ACM&coll=DL ▪ Hohpe, G., & Woolf, B. (2003). Enterprise integration patterns: Designing, building, and deploying messaging solutions. Addison-Wesley Professional. ▪ Lilienthal, C. (2019). Sustainable software architecture: Analyze and reduce technical debt. Apress. ▪ Richards, M., & Ford, N. (2020). Fundamentals of software architecture: An engineering approach [Electronic resource]. O'Reilly Media. ▪ Starke, G., & Lorz, A. (2023). Software architecture foundation: CPSA foundation exam preparation. dpunkt.verlag. ▪ Starke, G., Simons, M., Zörner, S., & Müller, R. D. (2019). arc42 by example: Software architecture documentation in practice. Packt Publishing Limited.

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	☑ Review Book
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ 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	

Project: General Programming with C/C++

Module Code: DLBMINPAPCC_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

(Project: General Programming with C/C++)

Contributing Courses to Module

- Project: General Programming with C/C++ (DLBMINPAPCC01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

The course teaches concepts and functionalities of the programming languages C and C++ for application and product development. It focuses on the basic organization of programs, including pointers, memory models, and libraries, as well as the latest features of the C and C++ languages.

Learning Outcomes

Project: General Programming with C/C++

On successful completion, students will be able to

- use basic and modern C and C++ syntax. create drafts of processes and implement them in C/C++.
- understand the concepts of pointers and C-specific memory models, and apply them in their own programs.
- link their own C/C++ programs with existing libraries.
- apply the programming languages to solve problems.
- make instructive observations and gain experience in action.

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: General Programming with C/C++

Course Code: DLBMINPAPCC01_E

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

Course Description

This course provides participants with a basic understanding of the C and C++ programming languages. Through an introductory presentation on the importance of C and C++ for programming tasks in application and product development, students become familiar with basic programming concepts such as variables, constructors, loops, statements, and functions. The organization of programs is explained using pointers, underlying memory models, and library management. The latest features of the C and C++ programming languages, such as atomics and threads, are also discussed. A special feature of this course is its emphasis on theory-practice transfer through a real project that is implemented in practice. As part of the practical project, students work on a relevant question under the supervision of a lecturer.

Course Outcomes

On successful completion, students will be able to

- use basic and modern C and C++ syntax. create drafts of processes and implement them in C/C++.
- understand the concepts of pointers and C-specific memory models, and apply them in their own programs.
- link their own C/C++ programs with existing libraries.
- apply the programming languages to solve problems.
- make instructive observations and gain experience in action.

Contents

- This course introduces the main aspects of the programming languages C and C++, such as variables, constructors, loops, statements, and functions. The organization of programs is explained using pointers, memory models, and library management. Programming knowledge is deepened through practical implementation tasks.

Literature
Compulsory Reading
Further Reading ▪ Dimitrovic, S. (2023). Modern C++ for absolute beginners: A friendly introduction to the C++ programming language and C++11 to C++23 standards. Apress. ▪ Dimitrovic, S. (2024). Modern C for absolute beginners: A friendly introduction to the C programming language. Apress. ▪ Gustedt, J. (2019). Modern C [electronic resource]. Manning. ▪ Lischner, R. (2003). C++ in a nutshell. O'Reilly. ▪ Prinz, P., & Crawford, T. (2016). C in a nutshell: The definitive reference. O'Reilly Media. ▪ Viarheichyk, I. (2020). Embedded programming with modern C++ cookbook: Practical recipes to help you build robust and secure embedded applications on Linux. 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	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

4. Semester

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	

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: DLBCSEMSE1-01

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	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

(Mobile Software Engineering)

Contributing Courses to Module

- Mobile Software Engineering (DLBCSEMSE01-01)

Module Exam Type

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

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: DLBCSEMSE01-01

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.
- 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 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	☑ Review Book
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Audio	☑ Guideline
	☑ 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

Project: Software Engineering

Module Code: DLBCSPSE

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. Damir Ismailovic (Project: Software Engineering)

Contributing Courses to Module

- Project: Software Engineering (DLBCSPSE01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- The knowledge acquired in the computer science modules from study semesters 1-3 is applied in small to medium-sized projects. Implementation is carried out in groups of approximately 3-7 students. Important stages of the software life cycle are covered, and the corresponding artifacts (e.g., specification of requirements, design, implementation, tests, and documentation) are created by the students. The quality assurance of these artefacts is carried out by the tutor and by students from other project groups. The students should learn about both the creation and the quality assurance of artefacts in the SW process.

Learning Outcomes

Project: Software Engineering

On successful completion, students will be able to

- have experience working on a complex project on a practical scenario of industrial SW development.
- understand the typical risks and pitfalls of large software projects within the framework of project realization and be able to use targeted strategies to minimize risks.

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).

Project: Software Engineering

Course Code: DLBCSPSE01

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

Course Description

The knowledge acquired in the computer science modules from study semesters 1-3 is applied in small to medium-sized projects. Implementation is carried out in groups of approximately 3-7 students. Important stages of the software life cycle are covered, and the corresponding artifacts (e.g., specification of requirements, design, implementation, tests, and documentation) are created by the students. The quality assurance of these artefacts is carried out by the tutor and by students from other project groups. Students will learn about the creation and the quality assurance of artefacts in the software process.

Course Outcomes

On successful completion, students will be able to

- have experience working on a complex project on a practical scenario of industrial SW development.
- understand the typical risks and pitfalls of large software projects within the framework of project realization and be able to use targeted strategies to minimize risks.

Contents

Literature

Compulsory Reading

Further Reading

- none

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

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	☑ Slides	☑ Guideline

5. Semester

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
☑ Recorded Live Sessions	☑ Audio	
	☑ Slides	

Cloud Computing

Module Code: DLBDSCC

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 (Cloud Computing)

Contributing Courses to Module

- Cloud Computing (DLBDSCC01)

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

- Cloud computing fundamentals
- Relevant enabling technologies for cloud computing
- Introduction to serverless computing
- Established cloud platforms
- Cloud offerings for data science and analytics

Learning Outcomes

Cloud Computing

On successful completion, students will be able to

- understand the fundamentals of cloud computing and cloud service models.
- recognize enabling technologies that underlie current cloud offerings.
- cite the principles of serverless computing.
- analyze characteristics of established cloud offerings.
- describe cloud options for data science and machine learning

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

Cloud Computing

Course Code: DLBDSCC01

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

Course Description

Many of the recent advances in data science, particularly machine learning and artificial intelligence, rely on comprehensive data storage and computing power. Cloud computing is one way of providing that power in a scalable way, without considerable upfront investment in hardware and software resources. This course introduces the area of cloud computing together with its enabling technologies. Moreover, the most cutting-edge advances like serverless computing and storage are illustrated. Finally, a thorough overview on popular cloud offerings, especially in regard to analytics capabilities, is given.

Course Outcomes

On successful completion, students will be able to

- understand the fundamentals of cloud computing and cloud service models.
- recognize enabling technologies that underlie current cloud offerings.
- cite the principles of serverless computing.
- analyze characteristics of established cloud offerings.
- describe cloud options for data science and machine learning

Contents

1. Introduction to Cloud Computing
   - 1.1 Fundamentals of Cloud computing
   - 1.2 Cloud Service Models
   - 1.3 Benefits and Risks
2. Enabling Technology
   - 2.1 Virtualization and Containerization
   - 2.2 Storage Technology
   - 2.3 Networks and RESTful Services
3. Serverless Computing
   - 3.1 Introduction to Serverless Computing
   - 3.2 Benefits
   - 3.3 Limitations

4. Established Cloud Platforms
   - 4.1 General Overview
   - 4.2 Google Cloud Platform
   - 4.3 Amazon Web Services
   - 4.4 Microsoft Azure
   - 4.5 Platform Comparison

5. Data Science in the Cloud
   - 5.1 Provider-independent services and tools
   - 5.2 Google Data Science and Machine Learning Services
   - 5.3 Amazon Web Services Data Science and Machine Learning Services
   - 5.4 Microsoft Azure Data Science and Machine Learning Services

Literature

Compulsory Reading

Further Reading

- Goessling, S., & Jackson, K. L. (2018). Architecting cloud computing solutions. Packt Publishing.
- Mahmood, Z., Puttini, R., & Erl, T. (2013). Cloud computing: Concepts, technology & architecture. Prentice Hall.
- Sehgal, N. K., & Bhatt, P. C. P. (2023). Cloud computing with security and scalability: Concepts and practices.
- Zonooz, P., Farr, E., Arora, K., & Laszewski, T. (2018). Cloud native architectures. Packt Publishing.

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	

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 (X-Reality Project)

Contributing Courses to Module

- Augmented, Mixed and Virtual Reality (DLBMIAMVR01_E)
- X-Reality Project (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 X-Reality Project • 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

X-Reality Project

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.

X-Reality Project

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	

X-Reality Project

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 ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

X-Reality Project

Module Code: DLBMIAMVR2_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. Armin Grasnick (X-Reality Project)

Contributing Courses to Module

- X-Reality Project (DLBMIAMVR02_E)

Module Exam Type

Module Exam	Split Exam
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

Development of AR-/VR-Application; Design, Implementation and Documentation; Challenges and Problems

Learning Outcomes

X-Reality Project

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 field of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

X-Reality Project

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 ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Design Basics: Seeing and Understanding

Module Code: DLBKDDSV-02_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

(Design Basics: Seeing and Understanding)

Contributing Courses to Module

- Design Basics: Seeing and Understanding (DLBKDDSV01-02_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Advanced Workbook	

Weight of Module

see curriculum

Module Contents

- Basics of visual design
- Basics of perception
- Basic elements and design parameters
- Color
- Visual perception phenomena
- Digital image formats

Learning Outcomes

Design Basics: Seeing and Understanding

On successful completion, students will be able to

- know the basic functions and tasks of design and differentiate between design disciplines.
- explain and apply the different gestalt laws and perceptual organization forms.
- name basic elements of design and common design parameters and apply them in exercises.
- assess and explain works in terms of creative compositional possibilities.
- know the design element of color in its sub-areas of effect, mixture and composition, as well as to differentiate between the common color systems and to name them.
- differentiate between page formats and aspect ratios, develop a page layout and construct a design grid.
- explain and visualize the design process, reproduce the contents of a briefing and rebriefing and to create a briefing themselves.

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 field

Design Basics: Seeing and Understanding

Course Code: DLBKDDSV01-02_E

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

Course Description

Together with typography, the basics of design form the essential tools that every designer must master. Without this knowledge you can´t design products with high standards of content and form be created, consistently geared towards success. Understanding the laws of design, basic elements, and design parameters are as much a part of a professional designer's repertoire as a solid knowledge of color and an understanding of the construction and use of page layouts or design grids. The aim of the course is to impart this understanding to students and provide them with the necessary tools to implement design products.

Course Outcomes

On successful completion, students will be able to

- know the basic functions and tasks of design and differentiate between design disciplines.
- explain and apply the different gestalt laws and perceptual organization forms.
- name basic elements of design and common design parameters and apply them in exercises.
- assess and explain works in terms of creative compositional possibilities.
- know the design element of color in its sub-areas of effect, mixture and composition, as well as to differentiate between the common color systems and to name them.
- differentiate between page formats and aspect ratios, develop a page layout and construct a design grid.
- explain and visualize the design process, reproduce the contents of a briefing and rebriefing and to create a briefing themselves.

Contents

1. Basics of visual design
   - 1.1 Visual communication
   - 1.2 The design process
2. Basics of perception
   - 2.1 The eye as an organ of perception
   - 2.2 Pre-attentive processing
   - 2.3 Spatial resolution and visual representation
   - 2.4 Cognitive processing of visual impressions and pattern recognition

3. Basic elements and design parameters
   - 3.1 Point, line, shape
   - 3.2 Texture
   - 3.3 Forms and space
   - 3.4 Time and sequence

4. Visual perception phenomena
   - 4.1 Subjective constancy
   - 4.2 Gestalt principles
   - 4.3 Optical illusions
   - 4.4 Selective perception

5. Color
   - 5.1 Color effect
   - 5.2 Anthropological color models
   - 5.3 Technological color models
   - 5.4 Using color

6. Image file formats
   - 6.1 Basic knowledge of image file formats
   - 6.2 Raster graphics
   - 6.3 Vector graphics
   - 6.4 Compression methods for image file formats

Literature

Compulsory Reading

Further Reading

- Buxton, B. (2022). Design for the digital age: Crafting the next generation of products and services. New Riders.
- Kujala, S., & Roto, V. (2023). Advances in user experience and usability, Volume 2: Innovative approaches. Springer.
- Munzner, T. (2023). Visualization analysis and design (2nd ed.). CRC Press.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Special Course

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

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	☑ Reader	☑ Guideline
☑ Intensive Live Sessions/Learning Sprint	☑ Slides	
☑ Recorded Live Sessions		

User Experience

Module Code: DLBMIUEX1_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. Mathias Bauer (User Experience)

Contributing Courses to Module

- User Experience (DLBMIUEX01_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

- Basics of User Experience
- Customer Journey
- Selected UX Techniques
- UX Evaluation
- Information Design
- UX on a Large Scale

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.

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
☑ 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	

Cryptography

Module Code: DLBCSCT-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	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator
Prof. Dr. Ralf Kneuper (Cryptography)

Contributing Courses to Module
▪ Cryptography (DLBCSCT01-01)

Module Exam Type	
Module Exam Study Format: Distance Learning Written Assessment: Case Study Study Format: myStudies Written Assessment: Case Study	**Split Exam**
Weight of Module see curriculum	

Module Contents

- Protection Targets, Vulnerabilities, and Threats
- Foundations of Cryptology and its Core Components
- Basic Cryptographic Applications
- Authentication
- Single Computer Security
- Security Communication Network
- Security E-Commerce
- Secure Software Development

Learning Outcomes

Cryptography

On successful completion, students will be able to

- give an overview of different classes of cryptographic systems.
- give a basic description of symmetric cryptographic methods, in particular One-Time Pad, DES, and AES, and describe their operating principles by means of simple, concrete examples.
- describe the basic hash functions.
- describe basic asymmetric cryptographic methods, especially RSA, and their operating principles by means of simple, concrete examples.
- describe the areas of application of cryptographic procedures and their application scenarios.

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 Developement	All Bachelor Programs in the IT & Technology field

Cryptography

Course Code: DLBCSCT01-01

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

Course Description

This course covers basic and targeted in-depth knowledge of cryptographic processes and the practical use of cryptographic systems. After an overview of cryptographic methods, hash functions, symmetric methods, and asymmetric methods are presented. The theoretical basics of selected procedures are taught and practically explained using simple examples. In addition, areas of application and application scenarios for cryptographic procedures are presented.

Course Outcomes

On successful completion, students will be able to

- give an overview of different classes of cryptographic systems.
- give a basic description of symmetric cryptographic methods, in particular One-Time Pad, DES, and AES, and describe their operating principles by means of simple, concrete examples.
- describe the basic hash functions.
- describe basic asymmetric cryptographic methods, especially RSA, and their operating principles by means of simple, concrete examples.
- describe the areas of application of cryptographic procedures and their application scenarios.

Contents

1. Protection Goals, Vulnerabilities, and Threats
   - 1.1 Protection Goals
   - 1.2 Vulnerabilities and Threats
2. Foundations of Cryptology and its Core Components
   - 2.1 Encoding
   - 2.2 Symmetrical Encryption
   - 2.3 Asymmetric Encryption
   - 2.4 One-way Functions and Cryptographic Hash Functions
3. Basic Cryptographic Applications
   - 3.1 Key Exchange and Hybrid Processes
   - 3.2 Digital Signature

- 3.3 Message Authentication Code
- 3.4 Steganographic Methods

4. Authentication
   - 4.1 Passwords and Public-Key-Certificates
   - 4.2 Challenge-Response-Procedure and Zero-Knowledge-Procedure
   - 4.3 Biometric Methods
   - 4.4 Authentication in Distributed Systems
   - 4.5 Identities Through Smartcards

5. Security of Single Computers
   - 5.1 Malware and Cookies
   - 5.2 Some Special Features of Operating Systems
   - 5.3 Web Server Security

6. Security in Communication Networks
   - 6.1 Security Problems and Defense Concepts
   - 6.2 Internet Standards for Communication Security
   - 6.3 Identity and Anonymity
   - 6.4 Security in Mobile and Wireless Communications

7. Security in E-Commerce
   - 7.1 Email Security
   - 7.2 Online Banking and Online Payments
   - 7.3 Electronic Money

8. Secure Software Development
   - 8.1 Threat Modeling
   - 8.2 Secure Software Design
   - 8.3 Techniques for Safe Programming

Literature
Compulsory Reading
Further Reading ▪ Paar, C. & Pelzl, J. (2010). Understanding Cryptography. A Textbook for Students and Practitioners. Springer. ▪ Singh, S. (1999). The code book [electronic resource] : the science of secrecy from ancient Egypt to quantum cryptography (1. ed.). Anchor Books. ▪ Smart, N. P. (2016). Cryptography Made Simple. 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	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	
	☑ 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	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	

Mathematics I

Module Code: DLBCSM1

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. Veronica Mas (Mathematics I)

Contributing Courses to Module

- Mathematics I (DLBCSM101)

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 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

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.

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	

Digital and Information Technology

Module Code: DLBAETDIT_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

Kamran Mahmood (Digital and Information Technology)

Contributing Courses to Module

- Digital and Information Technology (DLBAETDIT01_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

- Mathematical Foundations of Digital Logic
- Representation, Synthesis and Analysis of Boolean Functions
- Combinational Logic
- Sequential Logic
- Arithmetic Circuits
- Introduction to Programmable Logic

Learning Outcomes

Digital and Information Technology

On successful completion, students will be able to

- understand and apply the mathematical principles of digital logic.
- understand the different ways in which combinational logic and sequential logic work.
- analyze and evaluate digital arithmaticcircuits.
- understand the characteristics of programmable logic devices and develop simple arithmaticcircuits on 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 Engineering.	All Bachelor Programs in the IT & Technology field.

Digital and Information Technology

Course Code: DLBAETDIT01_E

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

Course Description

Digital and information technology is one of the basic subjects in electrical engineering and provides interdisciplinary basic knowledge for advanced courses. These basics are required in many courses and modules, including the realization of transistor circuits or the design of hardware-related embedded systems. Due to advances in technology, digital systems are becoming increasingly important and often replace traditional analog systems. Digital and information technology is thus a tool for the electrical engineer that should be mastered in order to gain access to more advanced know-how. This module therefore focuses not only on the theoretical fundamentals of digital and information technology (mathematical principles, combinational logic and sequential logic) but also on the practical realization of digital systems such as arithmaticcircuits in programmable logic devices.

Course Outcomes

On successful completion, students will be able to

- understand and apply the mathematical principles of digital logic.
- understand the different ways in which combinational logic and sequential logic work.
- analyze and evaluate digital arithmaticcircuits.
- understand the characteristics of programmable logic devices and develop simple arithmaticcircuits on them.

Contents

1. Mathematical Foundations of Digital Logic
   - 1.1 Boolean Functions and Algebra
   - 1.2 Number Systems (Dual, Octal, Decimal, Hexadecimal) and their Application
   - 1.3 Basic Arithmetic Operations in Number Systems (Addition, Subtraction, Multiplication, Division)
   - 1.4 Coding Methods (BCD, Gray, ASCII Code)
   - 1.5 Introduction to Modulation Techniques
2. Representation, Synthesis and Analysis of Boolean Functions
   - 2.1 Disjunctive and Conjunctive Normal Form
   - 2.2 Karnaugh-Veitch Map
   - 2.3 Quine-McCluskey Algorithm

3. Combinational Logic
   - 3.1 Logic Gate
   - 3.2 Connection of Logic Gaes
   - 3.3 Substitution by NOR / NAND Gates

4. Sequential Logic
   - 4.1 Latches and Flipflops
   - 4.2 Counter and Frequency Divider
   - 4.3 Shift Register and Memory

5. State Machines
   - 5.1 Foundations
   - 5.2 Models for State Machines
   - 5.3 Representation of State Machines
   - 5.4 Event-driven / Clock-driven State Machines
   - 5.5 Synchronization of Parallel State Machines

6. Arithmatic Circuits
   - 6.1 Adders
   - 6.2 Subtractor Circuits
   - 6.3 Multiplication Circuits

7. Introduction to Programmable Logic
   - 7.1 Programmable Cell Logic and Programmable Logic Array
   - 7.2 Complex Programmable Logic Devices (CPLD)
   - 7.3 FPGAs
   - 7.4 Introduction to VHDL

Literature

Compulsory Reading

Further Reading

- Mano, M.,/Ciletti, M. (2013): Digital Design. With an Introduction to the Verilog HDL. 5th edition, Pearson, London.
- Holdsworth, B./Woods, C. (2002): Digital Logic Design. 4th edition, Newnes, London.
- Gazi, O (2019): A Tutorial Introduction to VHDL Programming. 1st edition, Springer, Singapore.

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	

Introduction to the Internet of Things

Module Code: DLBINGEIT_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. Marian Benner-Wickner (Introduction to the Internet of Things)

Contributing Courses to Module

- Introduction to the Internet of Things (DLBINGEIT01_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

- Internet of Things Fundamentals
- Social and Economic Significance
- Communication Standards and Technologies
- Data Storage and Processing
- Design and Development
- Applicability

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.

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	All Bachelor Programmes in the IT & Technology field

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
☑ 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	

Introduction to Data Science

Module Code: DLBDSIDS-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	Minimum 1 semester	WiSe/SoSe	English

Module Coordinator

Ha Ngo (Introduction to Data Science)

Contributing Courses to Module

- Introduction to Data Science (DLBDSIDS01-01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

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.

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 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	

Deep Learning

Module Code: DLBDBDL_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. Lino Antoni Giefer (Deep Learning)

Contributing Courses to Module

- Deep Learning (DLBDBDL01_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

- Introduction
- Introduction to Neural Networks
- Training Neural Networks
- Introduction to Deep Learning Frameworks
- Classification and Optimization
- Multilayer Neural Networks
- Convolutional Neural Networks

Learning Outcomes

Deep Learning

On successful completion, students will be able to

- place concepts of deep learning in the context of machine learning and artificial intelligence.
- define different types of regression and explain the implementation of logistic regression with perceptrons.
- explain the structure and function of simple neural networks.
- explain concepts and interrelationships in training of neural networks and to partially implement these concepts.
- differentiate between deep learning frameworks.
- implement, train and optimize neural networks with the help of a Deep Learning Framework
- understand the structure and functioning of Convolutional Neural Networks and train them using a Deep Learning Framework.

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

Deep Learning

Course Code: DLBDBDL01_E

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

Course Description

Owing to recent technological advances, some concepts and methods from artificial intelligence can now be applied in practice. A major concept affected by this progress are neural networks. Thanks to fast and inexpensive GPUs on the one hand and freely available and well-documented frameworks on the other hand, neural networks are used today to solve many different problems, from pattern recognition in text and images to the automated assessment of insurance claims. In this course, students are introduced to the basics of this technology and enabled to apply it using simple examples.

Course Outcomes

On successful completion, students will be able to

- place concepts of deep learning in the context of machine learning and artificial intelligence.
- define different types of regression and explain the implementation of logistic regression with perceptrons.
- explain the structure and function of simple neural networks.
- explain concepts and interrelationships in training of neural networks and to partially implement these concepts.
- differentiate between deep learning frameworks.
- implement, train and optimize neural networks with the help of a Deep Learning Framework
- understand the structure and functioning of Convolutional Neural Networks and train them using a Deep Learning Framework.

Contents

1. Introduction
   - 1.1 AI
   - 1.2 Machine Learning
   - 1.3 Deep Learning
   - 1.4 Deep Learning Frameworks
2. Introduction to Neural Networks
   - 2.1 Linear Regression
   - 2.2 Logistic Regression
   - 2.3 Perceptrons

- 2.4 Types of Perceptrons

3. Training Neural Networks
   - 3.1 Mean Square Deviation
   - 3.2 Gradient Method
   - 3.3 Multilayer Perceptron
   - 3.4 Backpropagation
   - 3.5 Implementing Backpropagation

4. Introduction to Deep Learning Frameworks
   - 4.1 Overview
   - 4.2 First Steps with Tensorflow
   - 4.3 Basic Concepts
   - 4.4 Mathematical Functions

5. Classification and Optimization
   - 5.1 Linear Classifier
   - 5.2 Cost Functions
   - 5.3 Parameter Configuration and Cross-Validation
   - 5.4 Stochastic Gradient Descent
   - 5.5 Mini-Batching
   - 5.6 Epochs

6. Multilayer Neural Networks
   - 6.1 Introduction and Motivation
   - 6.2 Structure and Mathematics
   - 6.3 Implementation with Tensorflow
   - 6.4 Adaptation of Existing Models
   - 6.5 Over-Adaptation and Possible Solutions

7. Convolutional Neural Networks
   - 7.1 Motivation and Fields of Application
   - 7.2 Structure
   - 7.3 CNNs for Text Analysis
   - 7.4 CNNs for Image Analysis

Literature
Compulsory Reading
Further Reading ▪ Alpaydin, E. (2008): Maschinelles Lernen. Oldenbourg Wissenschaftsverlag, München. ▪ Géron, A. (2017): Praxiseinstieg Machine Learning mit Scikit-Learn und TensorFlow. Konzepte, Tools und Techniken für intelligente Systeme. O'Reilly. ▪ Rashid, T. (2017): Neuronale Netze selbst programmieren. Ein verständlicher Einstieg mit Python. O'Reilly. ▪ Russel, S. (2012): Künstliche Intelligenz – Ein moderner Ansatz. Pearson, Hallbergmoos. ▪ Zhang, Y./Wallace, B. (2016): A Sensitivity Analysis of (and Practitioners' Guide to) Convolutional Neural Networks for Sentence Classification. In: Proceedings of the Eighth International Joint Conference on Natural Language Processing, IJCNLP 2017. Asian Federation of Natural Language Processing Taipei, Taiwan.

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	

Business Intelligence

Module Code: DLBCSEBI1

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. Maik Drozdzynski (Business Intelligence)

Contributing Courses to Module

- Business Intelligence (DLBCSEBI01)

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

- Motivation and Conceptualization
- Data Provision
- Data Warehouse
- Modeling of Multidimensional Data Spaces
- Analysis Systems
- Distribution and Access

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.

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

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: Object Oriented and Functional Programming with Python

Module Code: DLBDSOOFPP

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. Max Pumperla (Project: Object Oriented and Functional Programming in Python)

Contributing Courses to Module

- Project: Object Oriented and Functional Programming in Python (DLBDSOOFPP01)

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 are being introduced to the advanced programming concepts of object orientation and functional programming and how they are realized in the Python programming language.

Learning Outcomes

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 Programs in the IT & Technology field

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

Artificial Intelligence

Module Code: DLBDSEAIS1

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. Kristina Schaaff (Artificial Intelligence)

Contributing Courses to Module

- Artificial Intelligence (DLBDSEAIS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- 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.

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.

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
☑ 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	

Business 101

Module Code: DLBBAB_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. Andreas Herrmann (Business 101)

Contributing Courses to Module

- Business 101 (DLBBAB01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam or Written Assessment: Written Assignment, 90 Minutes Study Format: myStudies Exam or Written Assessment: Written Assignment, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Businesses and their environment
- Types of business organizations
- Management and structure of business
- Production of goods and services
- Marketing of products and services
- Management of labor
- Accounting in business

Learning Outcomes

Business 101

On successful completion, students will be able to

- apply business and economic thinking and working methods.
- explain economic subjects and questioning models of business administration.
- classify and formulate corporate goals.
- describe and apply a general business decision-making process.
- recognize and design the organizational structure and process organization in the company.

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 Programmes in the Business field

Business 101

Course Code: DLBBAB01_E

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

Course Description

Business 101 deals with the basics of general business administration. It provides students with an understanding of the fundamental questions of doing business. In addition, basic organizational approaches of companies are shown. With the successful completion of the course, the students have gained fundamental knowledge in general business administration. This course lays the foundation for the advanced modules in the further course of their studies.

Course Outcomes

On successful completion, students will be able to

- apply business and economic thinking and working methods.
- explain economic subjects and questioning models of business administration.
- classify and formulate corporate goals.
- describe and apply a general business decision-making process.
- recognize and design the organizational structure and process organization in the company.

Contents

1. Businesses and their environment
   - 1.1 Concepts of business
   - 1.2 A system of economic relationships
   - 1.3 Business environment
2. Types of business organizations
   - 2.1 Companies in production and service
   - 2.2 Divisions of companies
3. Management and structure of business
   - 3.1 Basics of Business Management
   - 3.2 Functions of organizations, managers and control
   - 3.3 The decision making process
   - 3.4 Organizational structure of business
4. Production of goods and services

4.1 Origin and development of the production process
4.2 Industrial strategy of business

5. Marketing of goods and services
   5.1 Goals and types of marketing
   5.2 Marketing mix

6. Management of labor
   6.1 Process of management of labor
   6.2 Demand in labor
   6.3 Human relations in organizations

7. Accounting in business
   7.1 Functions and goals of accounting
   7.2 Spheres of accounting
   7.3 Fundamental principles of accounting

Literature
Compulsory Reading
Further Reading ▪ Covey, S. R. (2013). *The 7 habits of highly effective people: powerful lessons in personal change* (25th anniversary edition). Simon & Schuster.

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 Written Assessment: Written Assignment, 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 Written Assessment: Written Assignment, 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

Introduction to User Research

Module Code: DLBUXEUR_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. Jonathan Black-Branch (Introduction to User Research)

Contributing Courses to Module

- Introduction to User Research (DLBUXEUR01_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

- User Centered Design Approach
- User Research Methods to determine user requirements
- Questionnaire design and interview methods
- Observation techniques
- Methods and tools of Service Design

Learning Outcomes

Introduction to User Research

On successful completion, students will be able to

- understand the approach of User Centered Design and apply it independently
- understand the difference between different User Research methods to determine user requirements and to select project-specific methods.
- know and apply Service Design approaches to the determination and consolidation of user research results.

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 & Management field(s).

Introduction to User Research

Course Code: DLBUXEUR01_E

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

Course Description

The goal is to teach user research techniques for the derivation of user requirements. For this purpose, the approach of User Centered Design is introduced to the students. Special attention is given to the planning of the context of use analysis. The main focus of the course is on the teaching of user research methods, which students can select and apply on a project-specific basis after completing the course. Besides interview methods, observation techniques are taught. The design of questionnaires, observation protocols as well as the development of moderation guidelines for Focus Groups are also covered. The course concludes with the derivation and consolidation of qualitative and quantitative user requirements. In addition, the approach to Service Design will be discussed and specific Service Design methods and tools are presented.

Course Outcomes

On successful completion, students will be able to

- understand the approach of User Centered Design and apply it independently
- understand the difference between different User Research methods to determine user requirements and to select project-specific methods.
- know and apply Service Design approaches to the determination and consolidation of user research results.

Contents

1. Basics and Definitions of Terms
   - 1.1 Definitions of User Research and User Requirements
   - 1.2 Goals and challenges of User Research
2. Basic Idea of the User Centered Design
   - 2.1 Understanding
   - 2.2 Design
   - 2.3 Envision
   - 2.4 Evaluate
   - 2.5 Iterative Design
   - 2.6 Implementation
3. Planning User Context Analysis

3.1 Reason, goals and procedure of the user context analysis
3.2 Select and recruit users for data collection
3.3 Preparatory Desk Research
3.4 Work products and roles in User Requirements Engineering

4. User Research Methods for the Determination of User Requirements
4.1 Observation Methods
4.2 Interview Methods
4.3 Questionnaires
4.4 Focus Groups
4.5 Cultural Probes

5. From User Context Information to User Requirements
5.1 Identify Requirements
5.2 Qualitative and Quantitative User Requirements
5.3 Derive and structure User Requirements
5.4 Consolidate User Requirements

6. Service Design Methods
6.1 Objectives and Approaches
6.2 User Journeys and Service Blueprints
6.3 System Maps
6.4 Writing User Stories
6.5 Writing Research Reports

Literature

Compulsory Reading

Further Reading

- Baxter, K., Courage, C., & Caine, K. (2015). Understanding your users (2nd ed.). Morgan Kaufmann.
- Goodman, E., Kuniavsky, M., & Moed, A. (2020). Observing the user experience (2nd ed.). MorganKaufmann.
- Marsh, S. (2018). User research: A practical guide to designing better products and services. KoganPage.
- Norman, D. (2013). The design of everyday things: Revised and expanded edition (2nd ed.). BasicBooks.
- Savarit, E. (2020). Practical user research. 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	

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	

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
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	

Introduction to Computer Graphics

Module Code: DLBAVRECC_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

(Introduction to Computer Graphics)

Contributing Courses to Module

- Introduction to Computer Graphics (DLBAVRECC01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Advanced Workbook	

Weight of Module

see curriculum

Module Contents

- Human visual system
- Basics of graphic systems
- Rendering
- Graphics pipeline

Learning Outcomes

Introduction to Computer Graphics

On successful completion, students will be able to

- fundamentally describe the structure and mode of operation of the human visual system.
- name the differences between monocular and binocular spatial perception and explain the most important depth cues.
- explain pixel-based graphics systems and apply different image formats.
- reproduce the basics of stereoscopy and explain the functionality of Head Mounted Displays (HMDs).
- apply the geometric principles of rendering.
- understand the graphics pipeline and real-time rendering.

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 Computer Graphics

Course Code: DLBAVRECC01_E

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

Course Description

Computer monitors and glasses for augmented reality (AR) or virtual reality (VR) graphically display computer-generated data. To develop an understanding of computer graphics, students are taught about the human visual system and various graphics systems. They learn the fundamentals of displaying 3D models on computer monitors and rendering.

Course Outcomes

On successful completion, students will be able to

- fundamentally describe the structure and mode of operation of the human visual system.
- name the differences between monocular and binocular spatial perception and explain the most important depth cues.
- explain pixel-based graphics systems and apply different image formats.
- reproduce the basics of stereoscopy and explain the functionality of Head Mounted Displays (HMDs).
- apply the geometric principles of rendering.
- understand the graphics pipeline and real-time rendering.

Contents

1. Basics of visual perception
   - 1.1 Optics, sensory and oculomotor functions of the eye
   - 1.2 Cognition in the visual system
   - 1.3 Limits of visual perception
2. Spatial perception
   - 2.1 Monocular depth and size perception
   - 2.2 Binocular depth perception
   - 2.3 Acoustic and physical spatial perception
3. Graphic systems
   - 3.1 Structure of pixel-based displays
   - 3.2 Display control
4. Basics of stereoscopy

4.1 Stereoscopic systems and formats
4.2 Integral photography, autostereoscopy and holography
4.3 Head-mounted displays

5. Rendering basics
5.1 D scene and geometric objects
5.2 Perspective and textures
5.3 Lighting and shading
5.4 Ray tracing

6. Graphics pipeline
6.1 Geometric transformations
6.2 Rasterization and antialiasing
6.3 Real-time rendering

Literature

Compulsory Reading

Further Reading

- Eck, D. J. (2024). Introduction to computer graphics. LibreTexts.
- Marschner, S. (2022). Fundamentals of computer graphics (5th ed.). CRC Press.
- Vince, J. (2020). Foundation mathematics for computer science: A visual approach [electronic resource]. Springer.
- Vince, J. (2022). Mathematics for computer graphics. 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	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	☑ Review Book
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
	☑ Audio	☑ Guideline
☑ Recorded Live Sessions	☑ Slides	

Seminar: Ethical and Social Aspects of XR

Module Code: DLBAVRSEGAXR_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

(Seminar: Ethical and Social Aspects of XR)

Contributing Courses to Module

- Seminar: Ethical and Social Aspects of XR (DLBAVRSEGAXR01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

The use of augmented, mixed, and virtual reality raises numerous social and ethical issues for which solutions, standards, and rules need to be found. Students will engage with the social, ethical, and psychological risks of XR applications and the discussion of corresponding solutions.

Learning Outcomes

Seminar: Ethical and Social Aspects of XR

On successful completion, students will be able to

- describe the role of AR/VR/XR as a technology, its opportunities and risks as well as its social relevance.
- explain the health effects of the increased use of XR.
- discuss and apply ethical principles relevant to issues in the field of AR/VR/XR discuss and apply them.
- research existing positions on the respective issues from the scientific literature, present them, and weigh them up against each other.
- document their findings in written form structured and comprehensibly.

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

Seminar: Ethical and Social Aspects of XR

Course Code: DLBAVRSEGAXR01_E

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

Course Description

The use of augmented, mixed, and virtual reality raises numerous societal, social, medical, and ethical questions. For example, the long-term psychological and physical consequences of using XR hardware are still unclear, meaning that addiction risks or vision problems, for example, cannot be ruled out. Some user groups could suffer from exclusion, while others could gain new horizons of experience through inclusion. The interaction between users in virtual space must also be given a framework through norms, rules, and guidelines. Students engage with a selected problem area in which the state of research and possible solutions are presented.

Course Outcomes

On successful completion, students will be able to

- describe the role of AR/VR/XR as a technology, its opportunities and risks as well as its social relevance.
- explain the health effects of the increased use of XR.
- discuss and apply ethical principles relevant to issues in the field of AR/VR/XR discuss and apply them.
- research existing positions on the respective issues from the scientific literature, present them, and weigh them up against each other.
- document their findings in written form structured and comprehensibly.

Contents

- The use of augmented, mixed, and virtual reality raises numerous societal, social, medical, and ethical questions. For example, the long-term psychological and physical consequences of using XR hardware are still unclear, meaning that addiction risks or vision problems, for example, cannot be ruled out. Some user groups could suffer from exclusion, while others could gain new horizons of experience through inclusion. The interaction between users in virtual space must also be given a framework through norms, rules, and guidelines. Students engage with a selected problem area in which the state of research and possible solutions are presented.

Literature

Compulsory Reading

Further Reading

- Blackwell, L., Ellison, N., Elliott-Deflo, N., Schwartz, R. (2019) "Harassment in Social Virtual Reality: Challenges for Platform Governance", *Proceedings of the ACM on Human-Computer Interaction*, Vol. 3, No. CSCW, Article 100 (November 2019), pp.1-26. .
- Doukianou, S., Lalioti, V. (2024). Framework for Social XR: Navigating Challenges, Ethics, and Opportunities for Authentic Community Engagement, *2024 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Orlando, FL, USA, 675-676, doi: 10.1109/VRW62533.2024.00134.
- Dwivedi, Y.K., Hughes, L., Baabdullah, A.M., Ribeiro-Navarrete, S., Giannakis, M., Al- Debei, M.M. & Wamba, S.F. (2022). Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy, *International Journal of Information Management 66*, 102542.
- Effing, R. (2024). Will the metaverse be out of control? Addressing the ethical and governance implications of a developing virtual society. *Digital Government: Research and Practice* Vol. 5 (3), Article 29, .
- Freeman, G., Zamanifard, S., Maloney, D. & Acena, D. (2022). Disturbing the Peace: Experiencing and Mitigating Emerging Harassment in Social Virtual Reality. *Proceedings of the ACM on Human-Computer Interaction*, Volume 6, Issue CSC, 1-30. .

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 ☑ Recorded Live Sessions	☑ Slides	☑ Guideline

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

UX Prototyping

Module Code: DLBUXUXP_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. Mathias Bauer (UX Prototyping)

Contributing Courses to Module

- UX Prototyping (DLBUXUXP01_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

- Explanation of different Types of Prototypes
- Description of different Prototyping Techniques
- Procedure in Prototyping
- Prototyping of Service Processes and User Experiences
- Prototyping of digital and physical Products

Learning Outcomes

UX Prototyping

On successful completion, students will be able to

- know the goals and approaches in UX prototyping.
- understand the difference between different types of prototypes and to select suitable ones for a specific project.
- use different prototyping techniques.
- outline the procedure in the prototyping process and to apply it independently.
- explain the prototyping of service processes and to be able to apply Ideation methods.

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 & Management field.

UX Prototyping

Course Code: DLBUXUXP01_E

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

Course Description

The goal is to give an overview of the possibilities and application goals of UX prototyping. First, different types of prototypes are differentiated, depending on the fidelity. The different types will be discussed depending on their respective objectives and purpose of use. The procedure and challenges of the prototyping process are also discussed. The main focus is on the teaching of different prototyping methods. Different techniques are presented and an overview of common tools is given. In addition, the special features of prototyping of service design processes will be discussed.

Course Outcomes

On successful completion, students will be able to

- know the goals and approaches in UX prototyping.
- understand the difference between different types of prototypes and to select suitable ones for a specific project.
- use different prototyping techniques.
- outline the procedure in the prototyping process and to apply it independently.
- explain the prototyping of service processes and to be able to apply Ideation methods.

Contents

1. Basics and Definitions of Terms
   - 1.1 Definition of the term: What is a prototype?
   - 1.2 Goals and approaches in prototyping
2. Types of Prototypes
   - 2.1 low Fidelity
   - 2.2 Mid Fidelity
   - 2.3 High Fidelity
   - 2.4 Dimensions of Fidelity
3. Prototyping Techniques
   - 3.1 Scribbles
   - 3.2 Wireframes

3.3 Storyboards
3.4 Video prototypes
3.5 Wizard of Oz
3.6 Prototyping Tools

4. The Prototyping Process
   4.1 Application of prototypes
   4.2 Define the objective of the prototypes
   4.3 Set Fidelity
   4.4 Select Prototyping Technology

5. Prototyping of digital and physical Products
   5.1 Challenges in prototyping digital products
   5.2 Challenges in prototyping physical products

6. Prototyping in Service Design
   6.1 Procedure for idea generation
   6.2 Ideation methods
   6.3 Prototyping of service processes and experiences

Literature

Compulsory Reading

Further Reading

- Coleman, B./Goodwin, D. (2017): Designing UX Prototyping: Because Modern Design Is Never Static. O'Reilly UK Ltd.
- Greenberg, S./ Carpendale, S./Marquardt, N./Buxton, B. (2011): Sketching User Experiences: The Workbook. Morgan Kaufmann.
- McElroy, K. (2016): Prototyping for Designers: Developing the Best Digital and Physical Products. O'Reilly Media, Sebastopol.
- Stickdorn, M./Hormess, M./Lawrence, A./Schneider, J. (2018): This is Service Design Doing. O'Reilly Media, Sebastopol.
- Warfel, T.Z. (2009): Prototyping: A Practioner's Guide. Rosenfeld Media, New York.

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: AWS - Cloud Essentials

Module Code: DLBPAWSCLES

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		English

Module Coordinator

Georgi Dimchev (Project: AWS - Cloud Essentials)

Contributing Courses to Module

- Project: AWS - Cloud Essentials (DLBPAWSCLES01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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.

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.

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

Module Code: DLBPAWSCLAD

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 (Project: AWS - Cloud Advanced)

Contributing Courses to Module

- Project: AWS - Cloud Advanced (DLBPAWSCLAD01)

Module Exam Type

Module Exam	Split Exam
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

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 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 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

System Pentesting Basics

Module Code: DLBCSESPB_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. Ahmed Taha (System Pentesting Basics)

Contributing Courses to Module

- System Pentesting Basics (DLBCSESPB01_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

- Penetration testing process
- Host-based penetration testing
- Exploitation of network services
- Web App penetration testing
- System hardening
- Ethical hacking

Learning Outcomes

System Pentesting Basics

On successful completion, students will be able to

- understand the basic organizational and compliance needs for penetration testing.
- identify the relevant components of modern-day IT system that may be exploitable.
- understand the underlying processes comprising a penetration testing.
- understand the most common attack vectors associated to hosts, networks and Web Apps as well as how to defend against those.
- familiarize themselves with real-world tools used by professional penetration testers.

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

System Pentesting Basics

Course Code: DLBCSESPB01_E

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

Course Description

System penetration testing is a vital process for finding and supporting the mitigation of vulnerabilities in IT systems before the attackers can exploit them. For that reason, many organizations employ such "pentesters", or ethical hackers, to test their software and hardware base (connectivity included) and fix the security issues that are found. This has become a cornerstone of modern security concepts. However, in order to be successful in this endeavor, a good knowledge of the different types of targeted IT systems is required. We refer to hosts, networks, Web Apps, and even cloud computing. In this course we present the fundamental aspects of IT systems, along with the processes, tools and techniques that comprise the industrial practice of penetration testing. Equipped with this knowledge, students will understand the mechanisms of a given attack, and start down the path of pentesting themselves.

Course Outcomes

On successful completion, students will be able to

- understand the basic organizational and compliance needs for penetration testing.
- identify the relevant components of modern-day IT system that may be exploitable.
- understand the underlying processes comprising a penetration testing.
- understand the most common attack vectors associated to hosts, networks and Web Apps as well as how to defend against those.
- familiarize themselves with real-world tools used by professional penetration testers.

Contents

1. Penetration Testing Goals and Industrial Perspective
    - 1.1 Organizational Benefits
    - 1.2 Ethical Hacking Framework
    - 1.3 Legal and Compliance Aspects
    - 1.4 Responsible Disclosure of Vulnerabilities
    - 1.5 Professional Penetration Testing Services and Certifications
2. Background Concepts
    - 2.1 Operating Systems
    - 2.2 Hardware Architectures
    - 2.3 Networking and Protocols

- 2.4 Web-Based Applications
- 2.5 Cloud Computing

3. Penetration Testing Process
   - 3.1 Planning and Reconnaissance
   - 3.2 Whitebox, Blackbox and Graybox Scanning
   - 3.3 Gaining Access
   - 3.4 Maintaining Access
   - 3.5 Analysis and Reporting
   - 3.6 Hardening and Mitigation

4. Operating System-Based Penetration Testing
   - 4.1 Common Misconfigurations
   - 4.2 Shellcode Attacks
   - 4.3 Memory Corruption and Buffer Overflow Vulnerabilities
   - 4.4 Metasploit and Kali Tools
   - 4.5 Operating System Hardening

5. Network Penetration Testing
   - 5.1 Network Infrastructure Scoping and Recon
   - 5.2 Exploiting Network Services
   - 5.3 Lateral Movement in the Network
   - 5.4 Kerberos Attacks
   - 5.5 Toolset: Nmap, PowerShell, Bloodhound, and Tcpdump
   - 5.6 Devising Corrective Actions

6. Web App Penetration Testing
   - 6.1 The OWASP Methodology
   - 6.2 Open Source Intelligence (OSINT)
   - 6.3 Commonly Exploited Web App Vulnerabilities
   - 6.4 Exploitation Toolset: BurpSuite, sqlmap, BeEF and ExploitDB
   - 6.5 Reporting Findings and Mitigation Actions

7. Specialized Penetration Testing at a Glance
   - 7.1 Exploit Development
   - 7.2 Ethical Hacking
   - 7.3 Wireless and Mobile Device Penetration Testing
   - 7.4 Cloud Threat and Vulnerability Assessment

Literature
Compulsory Reading
Further Reading ▪ Hooley, G., Piercy, N., & Nicoulaud, B. (2011). Marketing strategy and competitive positioning (5th ed.). Prentice Hall. ▪ Kaplan, R., Norton, D., & Rugelsjoen, B. (2010). Managing alliances with the balanced scorecard. Harvard Business Review, 88(1/2), 114–120. ▪ Hackman, J. R., & Walton, R. E. (1986). Leading groups in organizations. In P. S. Goodman (Ed.), Designing effective work groups (pp. 72–119). Jossey-Bass.

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
	☑ 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	

Threat Modeling

Module Code: DLBCSEEFT1_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBCSRE01	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

Aleksandra Kornecka (Threat Modeling)

Contributing Courses to Module

- Threat Modeling (DLBCSEEFT01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Thinking C.I.A. and beyond
- Measuring the Cyber Threat
- Threat Modeling
- Attack libraries
- Rules, Regulations, and Law Enforcement
- Risk management
- Threat Mitigation

Learning Outcomes

Threat Modeling

On successful completion, students will be able to

- confidently think through eventual threats.
- model these threats using a common modelling methodology.
- find relevant techniques, tactics and procedures relating to a given scenario.
- calculate risk associate with the threat model.
- mitigate the risk by implementing design changes.

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

Threat Modeling

Course Code: DLBCSEEFT01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBCSRE01 or IREN01

Course Description

When a system or architecture is being created it is vital that possible threats are evaluated at the same time. By using both modeling methodologies and past observed attack patterns, it is possible to take a new or existing system and examine it for possible threats. With this analysis, possible risks and mitigations can be derived. While the most common methodologies are based on Attack Trees and the STRIDE model, recently attack modelling has also been using repositories of attacker techniques, tactics and procedures for inspiration.

Course Outcomes

On successful completion, students will be able to

- confidently think through eventual threats.
- model these threats using a common modelling methodology.
- find relevant techniques, tactics and procedures relating to a given scenario.
- calculate risk associate with the threat model.
- mitigate the risk by implementing design changes.

Contents

1. Thinking C.I.A. and beyond
   - 1.1 Confidentiality
   - 1.2 Integrity
   - 1.3 Availability
   - 1.4 Well-Known IT Security Issues
2. Measuring the Cyber Threat
   - 2.1 Concept of Threat Measuring
   - 2.2 Cyber Threat Metrics
   - 2.3 Measuring the Threat for an Organization
   - 2.4 Major Cyberattacks and their Impact
   - 2.5 Black Swan Events
3. Threat Modeling
   - 3.1 Attack Tree Methodology

3.2 STRIDE
3.3 DREAD
3.4 The Pyramid of Pain

4. Attack libraries
4.1 CAPEC
4.2 Solove's Taxonomy of Privacy
4.3 Mitre ATT&CK®
4.4 Identifying new Cyberattacks

5. Rules, Regulations, and Law Enforcement
5.1 Cyber Laws
5.2 Compliance and Law Enforcement

6. Risk management
6.1 Risk Management: An Overview
6.2 Incident Response and Crisis Management
6.3 Unpredictable Events (Black Swan)
6.4 Continuous Reevaluation

7. Threat Mitigation
7.1 Cyber Defense Tactics and Techniques
7.2 Risk Mitigation Strategies
7.3 Validation of Defenses
7.4 Security and Privacy by Design
7.5 Implementing Threat Mitigation in an Organization

Literature
Compulsory Reading
Further Reading ▪ CAPEC: Common Attack Pattern Enumeration and Classification. https://capec.mitre.org/ ▪ Kim, P. (2014): The Hacker Playbook: Practical Guide to Penetration Testing. Secure Planet LLC. ▪ Kim, P. (2015): The Hacker Playbook 2: Practical Guide to Penetration Testing. Secure Planet LLC. ▪ Kim, P. (2018): The Hacker Playbook 3: Practical Guide to Penetration Testing. Secure Planet LLC. ▪ Mitre ATT&CK®. https://attack.mitre.org/ ▪ Pfleeger, C. P. / Pfleeger, S. L. / Marguilies, J. (2015): Security in Computing. Fifth Edition, Pearson Education. ▪ Shostack, A. (2014): Threat Modeling: Designing for Security. John Wiley & Sons.

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	

Introduction to Robotics

Module Code: DLBROIR_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. Matthias Eifler (Introduction to Robotics)

Contributing Courses to Module

- Introduction to Robotics (DLBROIR01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies Exam or Written Assessment: Written Assignment, 90 Minutes Study Format: Distance Learning Exam or Written Assessment: Written Assignment, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Introduction to Robotics
- Trends
- Industrial Robots
- Mobile Robots
- Applications

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.

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 Engineering	All Bachelor Programmes in the IT & Technology field

Introduction to Robotics

Course Code: DLBROIR01_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 or Written Assessment: Written Assignment, 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 Written Assessment: Written Assignment, 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	

Embedded Systems

Module Code: DLBROES_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

Jacko Nudzor (Embedded Systems)

Contributing Courses to Module

- Embedded Systems (DLBROES01_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

- Embedded systems architecture
- Embedded hardware
- Embedded software
- Embedded Operating Systems
- Distributed systems and IoT architecture

Learning Outcomes

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 field of Engineering	All Bachelor Programmes in the IT & Technology field

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	

Statistical Computing

Module Code: DLBDBSC_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

Kamran Mahmood (Statistical Computing)

Contributing Courses to Module

- Statistical Computing (DLBDBSC01_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 to Statistical Computing
- Basics of programming with R
- Accessing data
- Descriptive statistics
- Inferential statistics
- Analysis of Variance
- Regression Analysis

Learning Outcomes

Statistical Computing

On successful completion, students will be able to

- classify and define the term statistical computing.
- create a PC working environment for the completion of tasks in the field of statistical computing.
- write simple programs with the R programming language.
- import and export data with R.
- apply different statistical methods with R, from descriptive statistics and inferential statistics to variance and regression analysis.

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

Statistical Computing

Course Code: DLBDBSC01_E

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

Course Description

Statistical computing combines the concepts and methods of statistics with tools from computer science. The results include statistics programs and programming languages that offer many useful functions for the analysis of digitally available data sources. In this course, students are taught the programming language R in order to be able to apply statistical methods (e.g. regression analysis, analysis of variance). In the context of a case study, the acquired skills will be used to extract correlations from complex data sources and to display them graphically.

Course Outcomes

On successful completion, students will be able to

- classify and define the term statistical computing.
- create a PC working environment for the completion of tasks in the field of statistical computing.
- write simple programs with the R programming language.
- import and export data with R.
- apply different statistical methods with R, from descriptive statistics and inferential statistics to variance and regression analysis.

Contents

1. Introduction to Statistical Computing
   - 1.1 Definition and Delimitation
   - 1.2 Statistics Program vs. Statistics Programming Language
   - 1.3 Setting Up the Working Environment
2. Basics of Programming with R
   - 2.1 R as Pocket Calculator
   - 2.2 Assignments and Variables
   - 2.3 Vectors and Matrices
   - 2.4 Logic
   - 2.5 Functions
   - 2.6 Data Types and Data Structures

3. Accessing Data
   - 3.1 Enter Data
   - 3.2 Import and Export of External Files
   - 3.3 Data Management in R

4. Descriptive Statistics
   - 4.1 Univariate Descriptive Statistics
   - 4.2 Bivariate Descriptive Statistics

5. Inferential Statistics
   - 5.1 Distributions
   - 5.2 Samples
   - 5.3 t-Tests

6. Analysis of Variance
   - 6.1 Principles and Delimitation to the t-Test
   - 6.2 One-way Analysis of Variance
   - 6.3 Two-way Analysis of Variance

7. Regression Analysis
   - 7.1 Correlation
   - 7.2 Linear Regression
   - 7.3 Other Models and Procedures

Literature

Compulsory Reading

Further Reading

- Hui, E. (2018): Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics. Apress, New York, New York, US.
- Toomey, D. (2017): Jupyter for Data Science. Exploratory analysis, statistical modeling, machine learning, and data visualization with Jupyter. Packt Publishing, Birmingham, UK.
- Wickham, H. and Grolemund, G. (2017): R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media, Sebastopol, California, US.

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
	☑ 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
	☑ Audio	
	☑ Slides	

Exploratory Data Analysis and Visualization

Module Code: DLBDSEDAV

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSIPWP01 or DLBDSIPWP01_D, DLBDSOOFPP01	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. Visieu Lac (Exploratory Data Analysis and Visualization)

Contributing Courses to Module

- Exploratory Data Analysis and Visualization (DLBDSEDAV01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Exploratory data analysis
- Principles of data visualization
- Established visualization types and apposite use cases
- Commonly-used Python modules for visualization
- Principles of effective visual communication

Learning Outcomes

Exploratory Data Analysis and Visualization

On successful completion, students will be able to

- recognize foundational concepts of exploratory data analysis.
- cite principles of data visualization.
- identify well-established types of visualizations and their appropriate uses.
- describe visualization best practices.
- understand practical data visualization fundamentals in Python.
- use different approaches for effective visual communication of data science results.

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

Exploratory Data Analysis and Visualization

Course Code: DLBDSEDAV01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSIPWP01 or DLBDSIPWP01_D, DLBDSOOFPP01

Course Description

Obtaining an overview of the salient characteristics of a data set is one of the core activities at the outset of any data analysis endeavour. The corresponding activities, methods, and techniques are grouped under the term “exploratory data analysis”. During exploratory data analysis, gaining insight into a given data set is often aided by the application of suitable visualization techniques. The utility of visualization, however, does not end at this stage; it is also crucial for communicating analytical outcomes. This course first introduces a set of approaches, tools, and techniques that are useful for exploring data sets. It then takes a thorough look at the subject area of visualization, which is presented in detail by an exposition arc that spans from first principles of visualization to practical implementation to insights into the communication of data science results and findings.

Course Outcomes

On successful completion, students will be able to

- recognize foundational concepts of exploratory data analysis.
- cite principles of data visualization.
- identify well-established types of visualizations and their appropriate uses.
- describe visualization best practices.
- understand practical data visualization fundamentals in Python.
- use different approaches for effective visual communication of data science results.

Contents

1. Exploratory Data Analysis
    - 1.1 Location and variability
    - 1.2 Further exploration of data distribution
    - 1.3 Covariance and correlation
2. Data Visualization Principles
    - 2.1 Coordinates and axes
    - 2.2 Color spaces
    - 2.3 Graph types
3. Data Visualization Practice

3.1 Amounts, proportions, associations, and distributions
3.2 Time series and trends
3.3 Geo-spatial data

4. Visualization in Python – Matplotlib and Seaborn
4.1 Introduction to PyPlot, Matplotlib, and Seaborn
4.2 Basic plots
4.3 Geo-spatial plots

5. Communicating Data Science
5.1 Unclutter, focus, and capture attention
5.2 Lessons from design
5.3 Principles of storytelling with data

Literature

Compulsory Reading

Further Reading

- Anderson, C. (2015). Creating a data-driven organization. O'Reilly Media.
- Bruce, A., & Bruce, P. (2017). Practical statistics for data scientists. O'Reilly Media.
- Grobmann, T., & Dobler, M. (2019). Data visualization with Python. Packt Publishing.
- Nussbaumer Knaflic, C. (2015). Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons.
- Wilke, C. O. (2019). Fundamentals of data visualization. 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	Written Assessment: Written 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	☑ 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: Written 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	☑ Audio	
	☑ Slides	

Data Management and ETL

Module Code: DLBBANDUE

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

N.N. (Data Management and ETL)

Contributing Courses to Module

- Data Management and ETL (DLBBANDUE01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Data Integration
- ETL Process
- ETL Tools
- Implementation Scenarios

Learning Outcomes

Data Management and ETL

On successful completion, students will be able to

- explain the basic concepts, types, and application areas of data management.
- identify and differentiate between different data types.
- introduce the terms ETL, ELT, and their sub-processes.
- name the main features and functionalities of ETL tools.
- explain an entire ETL process based on a real requirement scenario.
- present test procedures and methods for an ETL 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 Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

Data Management and ETL

Course Code: DLBBANDUE01

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

Course Description

Before BI-relevant data can be made available in the data warehouse, extensive data preparation activities are required. Structured data management forms the foundation for automated data integration. The two processes based on data extraction, ELT and ETL, will be presented, and their advantages and disadvantages shown to clarify which variant is most appropriate in different situations. ETL use cases and the benefits of ETL tools compared to hand coding will be demonstrated. Additionally, the course will explain what to consider when using ETL tools and highlight where common ETL tools differ from each other. Finally, common implementation procedures regarding the control and testing of the processes will be presented.

Course Outcomes

On successful completion, students will be able to

- explain the basic concepts, types, and application areas of data management.
- identify and differentiate between different data types.
- introduce the terms ETL, ELT, and their sub-processes.
- name the main features and functionalities of ETL tools.
- explain an entire ETL process based on a real requirement scenario.
- present test procedures and methods for an ETL process.

Contents

1. Basic Concepts, Types, and Application Areas of Data Management

2. Data Integration
   - 2.1 Problems and Challenges of Poor Data Quality
   - 2.2 Data Consolidation
   - 2.3 Strategy and Best Practices

3. ETL
   - 3.1 Tasks and Objectives
   - 3.2 Extraction
   - 3.3 Transformation
   - 3.4 Loading
   - 3.5 ETL vs. ELT

3.6 Optimization Procedures

4. ETL Tools
   - 4.1 Main Features and Functions
   - 4.2 Support for ETL and ELT
   - 4.3 Tools in the Open-Source Environment

5. Practical Implementation Scenarios
   - 5.1 Control of ETL Processes
   - 5.2 Test Scenarios and Methods
   - 5.3 Comparison and Evaluation of Methods

6. Outlook

Literature

Compulsory Reading

Further Reading

- Han, J., Pei, J., & Tong, H. (2023). ETL for data warehouses. In Data mining concepts and techniques (4th ed.). Elsevier.
- Paul, N. (2023). Practical Implementation of a Data Lake: Translating Customer Expectations into Tangible Technical Goals. Apress.
- Pethuru, R., Abhishek, K., García, D. V., & Nachamai, M. (2022). 10.2.2.4 ETL and Data Integration. In Demystifying Graph Data Science - Graph Algorithms, Analytics Methods, Platforms, Databases, and Use Cases. Institution of Engineering and Technology (The IET).
- Vaisman, A. (2022). Data warehouse systems: Design and implementation. In Data-centric systems and applications. Springer Berlin Heidelberg.
- Zineb, L., & Rachid, F. (2023). ETL Technologies for Big Data: A Comparative Study. In 2023 IEEE International Conference on Advances in Data-Driven Analytics And Intelligent Systems (ADACIS) (pp. 1–6). IEEE.

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		

Project: Business Intelligence

Module Code: DLBCSEBI2

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. Neil Arvin Bretana (Project: Business Intelligence)

Contributing Courses to Module

- Project: Business Intelligence (DLBCSEBI02)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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 **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 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: 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

Introduction to NLP

Module Code: DLBAIINLP

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. Kristina Schaaff (Introduction to NLP)

Contributing Courses to Module

- Introduction to NLP (DLBAIINLP01)

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 NLP
- Important methods in NLP
- Relevant Applications in NLP
- Challenges in NLP

Learning Outcomes

Introduction to NLP

On successful completion, students will be able to

- get a good overview of the topic NLP.
- name important challenges in NLP.
- apply common algorithms and methods to address NLP problems.
- understand common use-case scenarios in which NLP techniques are applied.
- analyze benefits and shortcomings of various NLP algorithms.

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 field of IT & Technology

Introduction to NLP

Course Code: DLBAIINLP01

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

Course Description

In this course, traditional and state-of-the-art approaches to Natural Language Processing will be taught. To achieve this goal, techniques, challenges, and solution approaches are presented with a comprehensive overview of related topics and techniques. Additionally, it will be shown how NLP can be used successfully in different application scenarios - both theoretically and with practical examples.

Course Outcomes

On successful completion, students will be able to

- get a good overview of the topic NLP.
- name important challenges in NLP.
- apply common algorithms and methods to address NLP problems.
- understand common use-case scenarios in which NLP techniques are applied.
- analyze benefits and shortcomings of various NLP algorithms.

Contents

1. Basic Terms and Concepts
   - 1.1 What is NLP?
   - 1.2 Syntax
   - 1.3 Semantics
   - 1.4 Prosodics
   - 1.5 Grammar
2. Language and Speech
   - 2.1 Human Vocal Apparatus
   - 2.2 Speech Production
   - 2.3 Phonetics
3. Challenges in NLP
   - 3.1 Data for NLP
   - 3.2 Evaluation of NLP Systems
   - 3.3 Domain Challenges

3.4 Multilingual Application

4. Techniques
   - 4.1 Rules vs. Statistics
   - 4.2 Regular Expressions
   - 4.3 N-Grams
   - 4.4 Vectorizing Data
   - 4.5 NLP Models

5. Application Scenarios
   - 5.1 Speech Recognition & Synthesis
   - 5.2 Machine Translation
   - 5.3 Information Extraction
   - 5.4 Sentiment Analysis
   - 5.5 Chatbot
   - 5.6 NLP with Python

Literature

Compulsory Reading

Further Reading

- Bird S., Klein, E., & Loper, E. (2009): Natural language processing with Python. O'Reilly, Sebastopol.
- Kamath , U., Liu, J., & Whitaker, J. (2019): Deep Learning for NLP and Speech Recognition:Practical NLP, Speech, and Deep Learning using Python-based Open Source Tools. Springer.
- Jurafsky, D., & Martin, J. H. (2020): Speech and language processing (3rd ed.). PrenticeHall, New Jersey. https://web.stanford.edu/~jurafsky/slp3

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
	☑ Audio	
☑ Recorded Live Sessions	☑ Slides	

Project: NLP

Module Code: DLBAIPNLP

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

Aditya Mushyam (Project: NLP)

Contributing Courses to Module

- Project: NLP (DLBAIPNLP01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

In this module students learn to put their theoretical knowledge in the field of NLP into practice. In this process, students learn to proceed analytically in order to find the optimal solution for a specific NLP task.

Learning Outcomes

Project: NLP

On successful completion, students will be able to

- apply knowledge of NLP methods to practical problems.
- evaluate and apply different methods, algorithms, and approaches to solve a given problem, taking into account its constraints.
- recognize the benefits and shortcomings of options and decisions.
- implement real-world NLP 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 Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

Project: NLP

Course Code: DLBAIPNLP01

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

Course Description

This course gives students the opportunity to apply their knowledge in NLP to a real implementation task. This requires finding an appropriate solution for a given task and associated constraints. Methodological and algorithmic choices must be appropriately evaluated to find the optimal way. The investigated solution will be implemented as executable software which promotes the students' programming skills.

Course Outcomes

On successful completion, students will be able to

- apply knowledge of NLP methods to practical problems.
- evaluate and apply different methods, algorithms, and approaches to solve a given problem, taking into account its constraints.
- recognize the benefits and shortcomings of options and decisions.
- implement real-world NLP applications.

Contents

- In this course, students put into practice the NLP knowledge acquired in previous courses by implementing a project of their choice.

Literature

Compulsory Reading

Further Reading

- Bird, S., Klein, E., & Loper, E. (2009). Natural language processing with Python. O'Reilly.
- Jurafsky, D., & Martin, J. H. (2020). Speech and language processing (3rd ed.). Prentice Hall.
- Kamath, U., Liu, J., & Whitaker, J. (2019). Deep learning for NLP and speech recognition: Practical NLP, speech, and deep learning using Python-based open source tools. 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	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

Change Management

Module Code: DLBDBCM_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. John Stanley (Change Management)

Contributing Courses to Module

- Change Management (DLBDBCM01_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

- Introduction to Change Management
- Understanding and shaping change
- Phase models of change management
- Phases of the change process
- Change communication
- Influencing factors and typical errors in change management
- Operational instruments in the context of change management

Learning Outcomes

Change Management

On successful completion, students will be able to

- explain the management of change in its broadest sense.
- identify the characteristics and procedures by which necessary changes in companies can beidentified and designed.
- grasp the basics of processes in change management and communicate them to otherparticipants.
- identify and analyze the need for change.
- outline typical tasks of managers in initiating and accompanying change processes.
- explain essential and effective techniques and tools of change processes and apply them.
- evaluate the success of change processes and measures.
- develop meaningful ways of dealing with resistance that arises in the change 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 fields of Business Administration & Management	All Bachelor Programs in the Business & Management fields

Change Management

Course Code: DLBDBCM01_E

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

Course Description

The pace of change in markets, technologies and customer behavior has increased significantly.These developments offer growth opportunities for companies - new business models, mergingmarkets, changed customer behavior. To utilize future potentials, companies need to implementchanges effectively and quickly. To do this, it is essential to know the meaning, structure, roles ofthe people involved, possible bottle neck situations and communication within the framework ofchange management. A great number of change programs regularly fail in the operationalimplementation. Therefore, knowledge of the systematic approach to the change process isnecessary to successfully manage change in and of the company. People and processes play acentral role in this procedure.

Course Outcomes

On successful completion, students will be able to

- explain the management of change in its broadest sense.
- identify the characteristics and procedures by which necessary changes in companies can beidentified and designed.
- grasp the basics of processes in change management and communicate them to otherparticipants.
- identify and analyze the need for change.
- outline typical tasks of managers in initiating and accompanying change processes.
- explain essential and effective techniques and tools of change processes and apply them.
- evaluate the success of change processes and measures.
- develop meaningful ways of dealing with resistance that arises in the change process.

Contents

1. Introduction to Change Management
    - 1.1 Terms and Definitions
    - 1.2 Limitations of Change Management
    - 1.3 Models of Change
2. Causes and Triggers of Change
    - 2.1 Change and Transformation
    - 2.2 External Triggers of Change

2.3 Internal Triggers for Change

3. The company as an Obstacle to Change
   - 3.1 Obstacles at Organizational Level
   - 3.2 Collective Obstacles
   - 3.3 Economic Obstacles

4. Resistance at Individual Level
   - 4.1 Manifestations of Individual Resistance
   - 4.2 Causes and Triggers of Individual Resistance
   - 4.3 Actions towards Resistance

5. Change as a Management Task
   - 5.1 Success Factors of Change Management
   - 5.2 Management Tasks in Change
   - 5.3 Change Management Activity Plans

6. Leading Change
   - 6.1 Success Factor: Leadership and Manager
   - 6.2 Leadership Roles and Functions
   - 6.3 Change Communication

7. Management of Change Projects
   - 7.1 Change Management Models
   - 7.2 Organization of Change Management
   - 7.3 Controlling and Evaluation of Change Projects

Literature

Compulsory Reading

Further Reading

- Lauer, T. (2021). Change management: Fundamentals and success factors. Springer Verlag.
- Hayes, J. (2018). The theory and practice of change management [electronic resource] (Fifth edition). Palgrave Macmillan.

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	

Project: Design Thinking for IT

Module Code: DLBWIPDTIT_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. Thomas Winkle (Project: Design Thinking for IT)

Contributing Courses to Module

- Project: Design Thinking for IT (DLBWIPDTIT01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

A comprehensive introduction to the Design Thinking method, its micro and macro process, and covers in detail the techniques and methods of all phases of the process - from understanding and exploring problems, defining a defining a point of view, idea generation, prototyping and testing. The focus is on the planning, documentation and evaluation of a practical project.

Learning Outcomes

Project: Design Thinking for IT

On successful completion, students will be able to

- understand the basic principles and mindset of design thinking in the context of IT projects.
- assess the applicability of design thinking to IT-related challenges and projects and identify suitable areas of application in the conception and development of IT systems.
- differentiate the individual phases and process steps of design thinking and their meaningfulness, relevance and applicability in relation to specific roles and areas of responsibility in the context of different IT projects.
- distinguish methods and tools for the individual phases and steps and be able to apply user-centered IT solutions.
- go through the macro process by means of iterative prototyping using an exemplary IT project.

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

Project: Design Thinking for IT

Course Code: DLBWIPDTIT01_E

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

Course Description

Students are introduced to the world of design thinking, an innovative method for solving complex problems and developing innovations. Design thinking, originally developed in product design, has gained in importance in recent years and is increasingly being used in various industries and specialist disciplines. In this discipline, it is important to place the user at the center of project work and to develop solutions that are geared towards their needs. Students learn the basic principles of design thinking and the specific methods for the various phases of the process - from gathering information, analyzing and defining a problem, generating ideas and prototyping through to testing. Especially in the dual distance learning program: In the dual distance learning program, the theory-practice transfer must be carried out based on a real project that is implemented in a practical company. As part of the practical project, students work on a practice-relevant issue at their practical company under the supervision of a teacher and the practice partner.

Course Outcomes

On successful completion, students will be able to

- understand the basic principles and mindset of design thinking in the context of IT projects.
- assess the applicability of design thinking to IT-related challenges and projects and identify suitable areas of application in the conception and development of IT systems.
- differentiate the individual phases and process steps of design thinking and their meaningfulness, relevance and applicability in relation to specific roles and areas of responsibility in the context of different IT projects.
- distinguish methods and tools for the individual phases and steps and be able to apply user-centered IT solutions.
- go through the macro process by means of iterative prototyping using an exemplary IT project.

Contents

- After an introduction to the basic principles of Design Thinking, students familiarize themselves with the framework and its broad application in IT. They learn about the micro and macro processes of Design Thinking and learn how to work effectively at different stages of the process and which methods they can use. The participants then explore techniques

for understanding, exploring and defining the problem space, generating ideas, prototyping and testing ideas. The aim of the course is to acquire practical skills and knowledge that will enable students to successfully integrate and apply design thinking in their future projects.

Literature

Compulsory Reading

Further Reading

- Hehn, J., Mendez, D., Brenner, W., & Broy, M. (2022). *Design thinking for software engineering: Creating human-oriented software-intensive products and services*. Springer Nature.
- Meinel, C., & Leifer, L. (Eds.). (2021). *Design thinking research: Interrogating the doing*. Springer Nature.
- Lewrick, M., Link, P., & Leifer, L. (2018). *The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems*. John Wiley & Sons.
- Grimsgaard, W. (2022). *Design and strategy: A step-by-step guide*. Taylor & Francis.

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 ☑ Course Feed ☑ Intensive Live Sessions/Learning Sprint ☑ Recorded Live Sessions	**Exam Preparation** ☑ 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	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

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 ☑ 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	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

6. 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. Damir Ismailovic (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	

Programming of Web Applications - Web-based Business Information Systems

Module Code: DLBITOWAWBI-01_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	keine	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. Marian Benner-Wickner (Programmierung von Web-Anwendungen - webbasierte betriebliche Informationssysteme)

Contributing Courses to Module

- Programmierung von Web-Anwendungen - webbasierte betriebliche Informationssysteme (DLBITOWAWBI01-01)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudium Schriftliche Ausarbeitung: Fallstudie Study Format: Fernstudium Schriftliche Ausarbeitung: Fallstudie Study Format: Duales myStudium Schriftliche Ausarbeitung: Fallstudie	

Weight of Module

see curriculum

Module Contents

Learning Outcomes

Programmierung von Web-Anwendungen - webbasierte betriebliche Informationssysteme

On successful completion, students will be able to

- die Architektur von Enterprise-Web-Anwendungen darzustellen sowie deren Zusammenhänge und Strukturen zu erläutern.
- relevante Technologien, Standards und Frameworks zur Erstellung von Enterprise-Web-Anwendungen identifizieren, ihre Unterschiede ausführen und deren Bedeutung begreifen.
- praktische Erfahrungen in der Nutzung verschiedener Web-Technologien zur Implementierung von Anwendungen sammeln.
- eigenständig geeignete Anwendungen zur Lösung spezifischer Probleme von Web-Anwendungen zu erstellen.

Links to other Modules within the Study Program	**Links to other Study Programs of the University**

Programmierung von Web-Anwendungen - webbasierte betriebliche Informationssysteme

Kurscode: DLBITOWAWBI01-01

Niveau	Kurs- und Prüfungssprache	SWS	CP	Zugangsvoraussetzungen
BA	Deutsch		5	keine

Beschreibung des Kurses

Die Studierenden erhalten eine tiefe und umfassende Einführung in die Programmierung von Web-Anwendungen. Konzepte von der Client-Server-Architektur über 3-Schichten-Architekturen bis hin zum Modell-View-Controller-Konzept werden ausführlich behandelt. Eine Einführung in typische Java Enterprise-Technologien rundet das vermittelte Wissen ab. Darüber hinaus wird der Bezug von Anwendungsentwicklung zur Datenbankprogrammierung und dem Einsatz von objektrelationalen Mappern, zum Beispiel Hibernate, behandelt. In weiteren Abschnitten werden komponentenbasierte Web-Benutzerschnittstellen wie Java Server Faces und deren Komponenten eingeführt. Schließlich wird auch die Verknüpfung von View und Model durch die Verwendung von Managed Beans und Unified Expression Language und die Anwendung von Komponentenbibliotheken vermittelt. Die erlernen Studierenden die Softwareentwicklung von Web-Services und Web-Anwendungen ab mittels Spring Boot kennen.

Kursziele

On successful completion, students will be able to

- die Architektur von Enterprise-Web-Anwendungen darzustellen sowie deren Zusammenhänge und Strukturen zu erläutern.
- relevante Technologien, Standards und Frameworks zur Erstellung von Enterprise-Web-Anwendungen identifizieren, ihre Unterschiede ausführen und deren Bedeutung begreifen.
- praktische Erfahrungen in der Nutzung verschiedener Web-Technologien zur Implementierung von Anwendungen sammeln.
- eigenständig geeignete Anwendungen zur Lösung spezifischer Probleme von Web-Anwendungen zu erstellen.

Kursinhalt

1. Objektorientierte Webentwicklung
   - 1.1 Aufbau und Überblick von Web-Architekturen
   - 1.2 Grundlegende Web-Architekturen: Client-Server, 3-Schichten-Architektur und Model-View-Controller
   - 1.3 Typische Java Enterprise (Java EE)-Architekturen
2. Grundlagen zur Erstellung betrieblicher Web-Anwendungen

2.1 Das HTTP-Protokoll in der Anwendungsentwicklung
2.2 Datenbankprogrammierung
2.3 Einsatz Object-Relationaler Mapper am Beispiel von Hibernate

3. Komponentenbasierte Web-Benutzerschnittstellen
   3.1 Einführung in Java Server Faces (JSF)
   3.2 JSF-Komponenten

4. Programmierung von Geschäftslogik
   4.1 Validierung von Benutzereingaben
   4.2 Konvertierung von Zahlen, Währungen und Datumsfeldern
   4.3 Definition von Fehlermeldungen
   4.4 Seitennavigation mit JSF-Anwendungen
   4.5 JSF-Lebenszyklus und Eventhandling

5. Verknüpfung von View und Model
   5.1 Managed Beans
   5.2 Unified Expression Language (UEL)

6. Entwicklung von Anwendungen mit Komponentenbibliotheken und Spring Boot
   6.1 Komponentenbibliotheken
   6.2 Web-Services mit Spring Boot
   6.3 Entwicklung von Web-Anwendungen mit Spring Boot

Literatur

Pflichtliteratur

Weiterführende Literatur

- Golubski, W. (2019). Entwicklung verteilter Anwendungen: Mit Spring Boot & Co. Springer Fachmedien Wiesbaden.
- Jendrock, E., Cervera-Navarro, R., Evans, I., Haase, K., & Markito, W. (2014). Java Platform, Enterprise Edition: The Java EE Tutorial Release 7. Retrieved December 8, 2023.
- Reddy, K.S.P., & Upadhyayula, S. (2022). Beginning Spring Boot 3. Apress.
- Simons, M. (2018). Spring Boot 2: Moderne Softwareentwicklung mit Spring 5 (1. Aufl.). dpunkt.verlag GmbH.
- Vonhoegen, H. (2011). Einstieg in XML: Grundlagen, Praxis, Referenzen (6. Aufl.). Galileo Computing.
- Wagenpfeil, S. (2023). Moderne Software-Entwicklung mit Java und JEE. Springer Vieweg.

Studienformat myStudium

Studienform	**Kursart**
myStudium	Theoriekurs

Informationen zur Prüfung	
Prüfungszulassungsvoraussetzungen	**Online Tests:** Ja
Prüfungsleistung	Schriftliche Ausarbeitung: Fallstudie

Zeitaufwand Studierende					
Selbststudium	**Präsenzstudium**	**Tutorium/ Tutorielle Betreuung**	**Selbstüberprüfung**	**Praxisanteil**	**Gesamt**
110 h	0 h	20 h	20 h	0 h	150 h

Lehrmethoden		
Tutorielle Betreuung	**Lernmaterial**	**Prüfungsvorbereitung**
☑ Course Feed	☑ Skript	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Prüfungsleitfaden
☑ Recorded Live Sessions	☑ Folien	

Studienformat Fernstudium

Studienform	**Kursart**
Fernstudium	Theoriekurs

Informationen zur Prüfung	
Prüfungszulassungsvoraussetzungen	**Online Tests:** Ja
Prüfungsleistung	Schriftliche Ausarbeitung: Fallstudie

Zeitaufwand Studierende					
Selbststudium	**Präsenzstudium**	**Tutorium/ Tutorielle Betreuung**	**Selbstüberprüfung**	**Praxisanteil**	**Gesamt**
110 h	0 h	20 h	20 h	0 h	150 h

Lehrmethoden		
Tutorielle Betreuung	**Lernmaterial**	**Prüfungsvorbereitung**
☑ Course Feed	☑ Skript	☑ Online Tests
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Prüfungsleitfaden
☑ Recorded Live Sessions	☑ Folien	

Studienformat Duales myStudium

Studienform	**Kursart**
Duales myStudium	Theoriekurs

Informationen zur Prüfung	
Prüfungszulassungsvoraussetzungen	**Online Tests:** Ja
Prüfungsleistung	Schriftliche Ausarbeitung: Fallstudie

Zeitaufwand Studierende					
Selbststudium	**Präsenzstudium**	**Tutorium/ Tutorielle Betreuung**	**Selbstüberprüfung**	**Praxisanteil**	**Gesamt**
110 h	0 h	20 h	20 h	0 h	150 h

Lehrmethoden		
Tutorielle Betreuung	**Lernmaterial**	**Prüfungsvorbereitung**
☑ Course Feed	☑ Skript	☑ Repetitorium
☑ Intensive Live Sessions/Learning Sprint	☑ Video	☑ Online Tests
☑ Recorded Live Sessions	☑ Folien	☑ Prüfungsleitfaden

Object-oriented Programming with C#

Module Code: DLBAVROOPC_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

(Object-oriented Programming with C#)

Contributing Courses to Module

- Object-oriented Programming with C# (DLBAVROOPC01_E)

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

- Object-oriented design
- Basic C# language constructs
- Object-oriented programming with C#
- Exception handling
- Creating, writing and reading files
- Further topics (e.g. event handling, lambda expression, namespace etc.)

Learning Outcomes

Object-oriented Programming with C#

On successful completion, students will be able to

- understand object-oriented design concepts and use them in their own solutions.
- recognize and understand the difference between object-oriented design and object-oriented programming.
- use the basic C# language elements to create simple solutions.
- create programs using the object-oriented features of C#.
- also use advanced C# features such as error handling, input and output control, event handling, etc.

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

Object-oriented Programming with C#

Course Code: DLBAVROOPC01_E

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

Course Description

C# is a modern, universal and very versatile programming language that can be used for a wide range of tasks in various specialist areas, e.g. mobile apps, desktop applications, cloud-based services, websites, enterprise software and games. It is particularly widely used for game development in conjunction with popular game engines such as Unity. The course provides students with the basic skills required for object-oriented programming with C#. It introduces students to the relevant theoretical concepts of object-oriented design (OOD) and how it can be implemented using classes, objects, methods and more. In addition, the basic constructs such as data types, variables and operators are introduced. The course also teaches the use of control structures, arrays and collections that enable processing flow and data organization. Students will learn how to make their code more robust using functions such as error and exception handling. Other useful functions such as namespaces, events, lambda expressions etc. are also introduced. After completing the course, students will be able to create their own object-oriented solutions in C#.

Course Outcomes

On successful completion, students will be able to

- understand object-oriented design concepts and use them in their own solutions.
- recognize and understand the difference between object-oriented design and object-oriented programming.
- use the basic C# language elements to create simple solutions.
- create programs using the object-oriented features of C#.
- also use advanced C# features such as error handling, input and output control, event handling, etc.

Contents

1. Object-oriented design
    - 1.1 Basics of object-oriented system development
    - 1.2 Fundamentals of object-oriented modeling
    - 1.3 Introduction to C#
2. C# language constructs
    - 2.1 primitive data types

- 2.2 variables
- 2.3 operators and expressions
- 2.4 control structures and statements
- 2.5 arrays and collections

3. object-oriented programming with C#
   - 3.1 struct
   - 3.2 classes, objects and methods
   - 3.3 constructors
   - 3.4 inheritance, polymorphisms, virtual methods
   - 3.5 encapsulation
   - 3.6 abstraction
   - 3.7 interfaces

4. exception handling and error handling
   - 4.1 exception handling
   - 4.2 error handling

5. input and output
   - 5.1 creating and writing files
   - 5.2 read file contents
   - 5.3 handling data carriers and folders

6. further concepts
   - 6.1 events and event handling
   - 6.2 lambda expressions
   - 6.3 namespace and the use of directives

Literature
Compulsory Reading
Further Reading ▪ Vystavěl, R. (2021). *C# programming for absolute beginners: Learn to think like a programmer and start writing code* (2nd ed.). Apress. ▪ Sarcar, V. (2022). *Simple and efficient programming with C#: Skills to build applications with Visual Studio and .NET*. Apress. ▪ Sarcar, V. (2022a). *Test your skills in C# programming: Review and analyze important features of C#*. Apress. ▪ Hardman, C. (2020). *Game programming with Unity and C#: A complete beginner's guide*. Apress.

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	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis 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	☑ Review Book
	☑ Audio	☑ Online Tests
☑ Recorded Live Sessions	☑ Slides	☑ Guideline

Application Development with Unity

Module Code: DLBAVRAEU_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

(Application Development with Unity)

Contributing Courses to Module

- Application Development with Unity (DLBAVRAEU01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Workbook	

Weight of Module

see curriculum

Module Contents

- Unity basics
- Basics of scene design in Unity
- Basics of programming and interaction
- User interface and networking in Unity
- Virtual reality integration
- Tutorial: Creating a sample application

Learning Outcomes

Application Development with Unity

On successful completion, students will be able to

- understand the basics of a game engine and the goals of Unity, as well as the product life cycle and key elements of its application.
- create, manage, and publish Unity applications.
- create and edit basic scene elements such as Game Objects, Prefabs, Primitives, Camera, Light, Materials, Textures, and Physics (game physics settings).
- create C# scripts using the scripting tools in Unity.
- familiarize themselves with important features for user interfaces, video, audio integration, and the networking features available in Unity for multi-user and collaborative applications.
- develop and roll out VR projects and apps that utilize traditional interactions of the Unity XR Interaction Toolkit and run on Unity-enabled VR devices (head-mounted displays).

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

Application Development with Unity

Course Code: DLBAVRAEU01_E

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

Course Description

Unity is one of the most popular game engines for developing 3D games and virtual reality applications, primarily due to the extensive support and numerous utilities it offers XR developers for creating VR and AR applications. The aim of this course is to provide knowledge of the key features of Unity that will enable participants to create both desktop and immersive XR experiences. The module focuses on introducing the 3D capabilities and features of Unity, starting with the creation and manipulation of 3D objects, and covering graphics basics such as prefabs, lighting, particles, and materials, which are important tools for an artist, game developer, or developer of interactive 3D experiences. Participants will be introduced to the project creation and management features that allow them to create and publish their own 3D Unity projects. Participants will also learn to create dynamic content using Unity's programming features that support the development of C# scripting components. For example, they will model the physics of objects or add dynamic interaction with various input devices supported by Unity, giving users control over the appearance and behavior of objects. The course also enables students to learn the basics of the user interface with the UI toolkit and experiment with audio and video in Unity. In addition, students will learn how to create immersive VR experiences using Unity-supported virtual reality devices, set up a VR project, and utilize Unity's XR features such as the XR Interaction Toolkit. This will allow students to configure interactions such as basic grabbing interactivity in VR, snapping, and locomotion.

Course Outcomes

On successful completion, students will be able to

- understand the basics of a game engine and the goals of Unity, as well as the product life cycle and key elements of its application.
- create, manage, and publish Unity applications.
- create and edit basic scene elements such as Game Objects, Prefabs, Primitives, Camera, Light, Materials, Textures, and Physics (game physics settings).
- create C# scripts using the scripting tools in Unity.
- familiarize themselves with important features for user interfaces, video, audio integration, and the networking features available in Unity for multi-user and collaborative applications.
- develop and roll out VR projects and apps that utilize traditional interactions of the Unity XR Interaction Toolkit and run on Unity-enabled VR devices (head-mounted displays).

Contents

1. Unity Basics
   - 1.1 Introduction to Unity
   - 1.2 Install Unity Hub
   - 1.3 Unity user interface basics
   - 1.4 Creating projects and scenes
   - 1.5 Creating and managing GameObjects
   - 1.6 Create a first application

2. Unity Scenes - Basics
   - 2.1 Computer graphics basics
   - 2.2 Importing and managing assets
   - 2.3 Animation and physics in Unity
   - 2.4 Audio integration
   - 2.5 Video integration

3. Basics of programming and interaction
   - 3.1 Visual Scripting
   - 3.2 C# Scripting with Unity
   - 3.3 Input basics

4. User interface and networking in Unity
   - 4.1 UI Toolkit
   - 4.2 Networking Essentials/Collaborative Environment

5. Virtual Reality Integration
   - 5.1 Introduction to Virtual Reality (VR)
   - 5.2 VR software setup in Unity
   - 5.3 VR Interaction Essentials
   - 5.4 Augmented Reality Essentials

6. Tutorial: Creation of a sample application
   - 6.1 Tutorial: Creating a sample application

Literature
Compulsory Reading
Further Reading ▪ Buttfield-Addison, P., Manning, J., & Nugent, T. (2023). Unity development cookbook. O'Reilly Media. ▪ Cameron, S. H. (2024). Unity 2022 by example: A project-based guide to building 2D and 3D games, enhanced for AR, VR, and MR experiences. Packt Publishing Limited. ▪ Christian, S. (2023). Enhancing virtual reality experiences with Unity 2022: Apply Unity's latest features to level up your skills for VR games, apps, and other projects. Packt Publishing. ▪ Ferrone, H. (2022). Learning C# by developing games with Unity: Get to grips with coding in C# and build simple 3D games in Unity 2022 from the ground up. Packt Publishing. ▪ Linowes, J. (2020). Unity 2020 virtual reality projects: Learn VR development by building immersive applications and games with Unity 2019.4 and later versions [electronic resource]. Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Special Course

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

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	☑ Reader	☑ Guideline
☑ Intensive Live Sessions/Learning Sprint	☑ Slides	
☑ Recorded Live Sessions		

Mobile App Design

Module Code: DLBMDMMD-01_E

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

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

Module Coordinator

(Mobile App Design)

Contributing Courses to Module

- Mobile App Design (DLBMDMMD01-01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Workbook	

Weight of Module

see curriculum

Module Contents

- Basics of mobile app design
- Mobile usability
- The typical project process
- App analysis and development of an own idea
- Interaction design and layout on small screens
- Prototyping and usability testing
- Publication of apps

Learning Outcomes

Mobile App Design

On successful completion, students will be able to

- critically analyze the function, usability, and design of mobile applications.
- realistically assess the possibilities and limitations of application design.
- reproduce and apply the typical project process in a structured manner.
- take into account mobile-specific features in interface design.
- develop and apply simple evaluation procedures for mobile apps.
- transfer the constraints for app publication to their own apps.

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 Media Production	All Bachelor Programs in the Design, Architecture & Construction field

Mobile App Design

Course Code: DLBMDMMD01-01_E

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

Course Description

Offering apps is no longer a unique endeavor limited to large companies or highly innovative start-ups. Mobile apps have become integral tools in our society, and the use of digital services via smartphones is constantly increasing. Meanwhile, the technical foundation of mobile apps is rapidly evolving. This course provides an overview of the steps involved in the conception and design of a mobile app. The focus is particularly on the specific functional, structural, and formal aesthetic requirements of the mobile platform. A user-centered development process is described and explained, covering its typical steps from conception to prototyping, testing, and publishing.

Course Outcomes

On successful completion, students will be able to

- critically analyze the function, usability, and design of mobile applications.
- realistically assess the possibilities and limitations of application design.
- reproduce and apply the typical project process in a structured manner.
- take into account mobile-specific features in interface design.
- develop and apply simple evaluation procedures for mobile apps.
- transfer the constraints for app publication to their own apps.

Contents

1. Basics of application design
   - 1.1 Definition of the term app(lication)
   - 1.2 Platforms iOS and Android
   - 1.3 The mobile use case
2. Usability of mobile user interfaces
   - 2.1 Principles for interaction design
   - 2.2 UI guidelines for mobile interaction
   - 2.3 Accessibility
3. Project process: From the idea to the app
   - 3.1 The human-centered design process
   - 3.2 Research

- 3.3 Analysis
- 3.4 Ideation
- 3.5 Implementation
- 3.6 Evaluation

4. Analysis and Ideation
   - 4.1 Research
   - 4.2 Analysis and target group definition
   - 4.3 Ideation

5. Interaction design
   - 5.1 Mobile User Experience Design
   - 5.2 Set the functional scope
   - 5.3 Information architecture and menu structures
   - 5.4 Design patterns and interaction elements
   - 5.5 Animations and transitions
   - 5.6 Iterative prototyping

6. Mobile layout
   - 6.1 Typography
   - 6.2 Color
   - 6.3 Layout and Responsive Design
   - 6.4 Use of photography and illustration
   - 6.5 Icons

7. Evaluation
   - 7.1 Test methods and procedures
   - 7.2 Debugging
   - 7.3 Analytical evaluation
   - 7.4 Empirical evaluation

8. Publication
   - 8.1 Requirements and constraints for publication
   - 8.2 Publication options for mobile apps
   - 8.3 Presentation of an app in the App Store
   - 8.4 Legal obligations

Literature
Compulsory Reading
Further Reading ▪ Fadda, M. (2024). An iOS developer's guide to SwiftUI: Design and build beautiful apps quickly and easily with minimum code. Packt Publishing. ▪ Smyth, N. (2024). Jetpack Compose 1.6 essentials: Developing Android apps with Jetpack Compose 1.6, Android Studio, and Kotlin. Payload Media, Inc. ▪ Perea, P., & Giner, P. (2017). UX design for mobile. Packt Publishing. ▪ Tidwell, J., Brewer, C., & Valencia, A. (2020). Designing interfaces: Patterns for effective interaction design [electronic resource]. O'Reilly. ▪ Vesselov, S., & Davis, T. (2019). Building design systems: Unify user experiences through a shared design language. Apress.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Special Course

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

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	☑ Reader	☑ Guideline
☑ Intensive Live Sessions/Learning Sprint	☑ Slides	
☑ Recorded Live Sessions		

Project: Application Design

Module Code: DLBKDPAPPD_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBMDMMD-01_E	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

(Project: Application Design)

Contributing Courses to Module

- Project: Application Design (DLBKDPAPPD01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

The students develop their own application design. From a brand-oriented application to an information-providing application, the topic is freely selectable—as long as the content can be implemented within a reasonable workload. From the analysis to the concept, to the design and implementation of the prototype, the students gain experience through the project process (including feedback). A current list of topics can be found in the Learning Management System.

Learning Outcomes

Project: Application Design

On successful completion, students will be able to

- work on an application design project in a structured manner.
- implement and confidently present the various production phases.
- explain the individual stages of prototyping and go through them in an example project.
- realistically estimate the time and cost of an application design project.

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 Media Production	All Bachelor Programs in the Design, Architecture & Construction field

Project: Application Design

Course Code: DLBKDPAPPD01_E

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

Course Description

Students learn about the structure of a professional application design workflow by going through a professional production process, from analysis and research to the finished prototype. By applying the knowledge they have learned, they can acquire their first skills in the rapidly growing field of application design. Sufficient feedback loops support additional practical relevance, with a self-critical look at the immanent factors of delivery date and budget.

Course Outcomes

On successful completion, students will be able to

- work on an application design project in a structured manner.
- implement and confidently present the various production phases.
- explain the individual stages of prototyping and go through them in an example project.
- realistically estimate the time and cost of an application design project.

Contents

- Using an example of their own choosing, students develop the process of an application design project, from analysis and research to conception and design, culminating in a presentation, at least as a low-fi prototype.
- Students can transfer their knowledge in the field of digital applications into practice and acquire initial implementation skills.

Literature
Compulsory Reading
Further Reading ▪ Fadda, M. (2024). An iOS developer's guide to SwiftUI: Design and build beautiful apps quickly and easily with minimum code. Packt Publishing. ▪ Hoober, S., & Berkman, E. (2012). Designing mobile interfaces [electronic resource]. O'Reilly. ▪ Neil, T. (2014). Mobile design pattern gallery: UI patterns for smartphone apps (2nd ed.) [electronic resource]. O'Reilly. ▪ Smyth, N. (2024). Jetpack Compose 1.6 essentials: Developing Android apps with Jetpack Compose 1.6, Android Studio, and Kotlin. Payload Media, Inc. ▪ Tidwell, J., Brewer, C., & Valencia, A. (2020). Designing interfaces: Patterns for effective interaction design [electronic resource]. O'Reilly. ▪ Vesselov, S., & Davis, T. (2019). Building design systems: Unify user experiences through a shared design language. Apress.

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

DevSecOps and Common Software Weaknesses

Module Code: DLBCSEDCSW_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBCSESPB01_E or DLBCSESPB01_D	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

N.N. (DevSecOps and Common Software Weaknesses)

Contributing Courses to Module

- DevSecOps and Common Software Weaknesses (DLBCSEDCSW01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Common code bugs
- Software Development Lifecycle
- DevOps
- DevSecOps
- Vulnerability reporting and bug bounty programs
- Patch management

Learning Outcomes

DevSecOps and Common Software Weaknesses

On successful completion, students will be able to

- avoid common software implementation and design mistakes.
- design a software development lifecycle process based on DevSecOps principles.
- incorporate vulnerability reporting and response into the SDL.
- organize and manage a bug bounty program.
- implement and manage a corporate patch management 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 fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

DevSecOps and Common Software Weaknesses

Course Code: DLBCSEDCSW01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBCSESPB01_E or DLBCSESPB01_D

Course Description

Modern organizations are run by software to some degree or another. In many cases, it is the custom software in business processes or products that is the key differentiator. But even companies that do no development of their own, are dependent on software and understanding software vulnerabilities is vital to their operations, as recent ransomware attacks have shown.In this course, we look at modern software development and lifecycle processes. Since its beginnings with Extreme Programming, there has been a shift away from the waterfall design to an agile development process. More recently, the Shift-Left movement has advocated for security to be considered from the start and not as an afterthought.In order to design secure software, it is naturally important to understand how insecurities creep into code. We look at the most important enumerations of software bugs: OWASP and Mitre's CWEs. Lastly, patch management has become the most import defensive tool for an organization. We look at this topic both from a software development perspective as well as from the customer's point of view.

Course Outcomes

On successful completion, students will be able to

- avoid common software implementation and design mistakes.
- design a software development lifecycle process based on DevSecOps principles.
- incorporate vulnerability reporting and response into the SDL.
- organize and manage a bug bounty program.
- implement and manage a corporate patch management process.

Contents

1. Introduction to the software development process
    - 1.1 Traditional software development: Waterfall design
    - 1.2 Iterative design
    - 1.3 Agile software development
    - 1.4 Operations as a separate process
    - 1.5 Infrastructure as code
    - 1.6 Merging Development and Operations: DevOps
2. DevOps best practices
    - 2.1 Coding: code development and review, source code management tools, code merging.

- 2.2 Building: continuous integration tools, build status.
- 2.3 Testing: continuous testing tools that provide quick and timely feedback on business risks.
- 2.4 Packaging: artifact repository, application pre-deployment staging.
- 2.5 Releasing: change management, release approvals, release automation.
- 2.6 Configuring: infrastructure configuration and management, infrastructure as code tools.
- 2.7 Monitoring: applications performance monitoring, end-user experience.

3. Sources of security bugs
   - 3.1 General classes of bugs
   - 3.2 Looking at the OWASP top ten
   - 3.3 Looking at the Mitre CWE™

4. DevSecOps
   - 4.1 Protection goals
   - 4.2 Threat modeling
   - 4.3 Choice of programming language, tool chain and infrastructure
   - 4.4 Linting for code security issues
   - 4.5 Testing for security
   - 4.6 Security by design/Shifting Left
   - 4.7 Security as a people problem
   - 4.8 Designing in a bug reporting and response process
   - 4.9 Managing a bug bounty program

5. Patch management
   - 5.1 Dilemma: software update churn vs security
   - 5.2 Vulnerability disclosures and the Mitre CVE™ process
   - 5.3 Coordinated vulnerability disclosure
   - 5.4 Program security vs Software-as-a-Service patching
   - 5.5 Deployment strategies for catching bugs early

6. Summary and research problems

Literature
Compulsory Reading
Further Reading ▪ Forsgren, N., Humble, J., & Kim, G. (2018). Accelerate: The science behind DevOps: Building and scaling high performing technology organizations (Illustrated ed.). IT Revolution Press. ▪ Kim, G., Humble, J., Debois, P., Willis, J., & Forsgren, N. (2021). The DevOps handbook: How to create world-class agility, reliability, & security in technology organizations (2nd ed.). IT Revolution Press. ▪ Toesland, F. (2019). The rise of DevSecOps. Computer Weekly.

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: Written 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

Learning Material
- ☑ Course Book
- ☑ Video
- ☑ Audio
- ☑ 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	Written Assessment: Written 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
	☑ Audio	
	☑ Slides	

Project: Agile DevSecOps Software Engineering

Module Code: DLBCSEEDSO1_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	IWNF01_E or DLBWIWTMAS01	BA	5	150 h

Semester / Term	Duration	Regularly offered in	Language of Instruction and Examination
see curriculum			English

Module Coordinator

N.N. (Project: Agile DevSecOps Software Engineering)

Contributing Courses to Module

- Project: Agile DevSecOps Software Engineering (DLBCSEEDSO01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

This module provides the fundamental security principles for leveraging DevOps in software engineering, also known as the DevSecOps paradigm. Given a security-relevant scenario, this module will illustrate good DevSecOps practices like definition of security baselines, threat modelling approaches, and security automation as part of the continuous integration/continuous development (CI/CD) pipeline.

Learning Outcomes

Project: Agile DevSecOps Software Engineering

On successful completion, students will be able to

- apply basic thread modelling into DevOps scenarios,
- familiarize with relevant DevOps security baselines from international standards and industrial good practices,
- select the appropriate tools and automation approaches for DevSecOps,
- design continuous compliance monitoring into Infrastructure-as-a-Code scenarios.

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: Agile DevSecOps Software Engineering

Course Code: DLBCSEEDSO01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	IWNF01_E or DLBWIWTMAS01

Course Description

This course covers the basic security principles for leveraging the DevSecOps approach in software engineering scenarios. The content of this course will illustrate the adoption of DevSecOps to continuously and holistically improve the security of an organization, rather than just focusing on protecting the underlying software infrastructure (as in the case of traditional non-agile methodologies). By presenting DevSecOps principles like threat modelling, definition of security baselines, security automation/tools, and continuous compliance monitoring, this course will teach how security can be integrated while developing a software engineering product.

Course Outcomes

On successful completion, students will be able to

- apply basic thread modelling into DevOps scenarios,
- familiarize with relevant DevOps security baselines from international standards and industrial good practices,
- select the appropriate tools and automation approaches for DevSecOps,
- design continuous compliance monitoring into Infrastructure-as-a-Code scenarios.

Contents

- Despite the broad adoption of DevOps in the industry, the integration of security principles into this paradigm (i.e., DevSecOps) is still an open challenge for many practitioners. In this course the students will learn fundamental DevSecOps concepts like threat modelling, definition of security baselines, continuous compliance monitoring, and integration of security automation in DevOps.

Literature
Compulsory Reading
Further Reading ▪ Johnson, E. (2020): Secure DevOps. A Practical Introduction. (URL: https://www.sans.org/ondemand/course/secure-dev-ops-a-practical-introduction [Retrieved: 15.08.2020]). ▪ Hsu, T. (2018): Hands-On Security in DevOps. Packt Publishing, UK. ▪ Microsoft. (2020): Secure DevOps. Making security principles and practices an integral part of DevOps while maintaining improved efficiency and productivity. (URL: https://www.microsoft.com/en-us/securityengineering/devsecops [Retrieved: 15.08.2020]). ▪ Schneider, C. (2015): Security DevOps. Staying secure in agile projects. (URL: https://owaspappseceurope2015.sched.com/event/378l/security-devops-staying-secure-in-agile-projects [Retrieved: 15.08.2020]). ▪ Yasar, H. (2016): An Introduction to Secure DevOps. Including Security in the Software Lifecycle. (URL: https://insights.sei.cmu.edu/devops/2016/11/an-introduction-to-secure-devops-including-security-in-the-software-lifecycle.html [Retrieved: 15.08.2020]).

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

Sensor Technology

Module Code: DLBROST_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. Matthias Eifler (Sensor Technology)

Contributing Courses to Module

- Sensor Technology (DLBROST01_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

- Sensors and transducers
- Resistive, capacitive, inductive, optical and acoustic sensor effects
- Transduction platforms and sensor systems
- Applications
- Advanced sensors

Learning Outcomes

Sensor Technology

On successful completion, students will be able to

- understand the main sensor characteristics.
- read and understand a typical sensor data sheet.
- understand sensor effects.
- understand and characterize sensor platforms.
- select the appropriate sensor technology for a given 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 Engineering	All Bachelor Programmes in the IT & Technology fields

Sensor Technology

Course Code: DLBROST01_E

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

Course Description

Sensors are at the base of any modern engineering system, for example, control systems in robotics. This course provides the basic knowledge to understand sensors and their characteristics. A specific sensor is chosen for an application mainly based on its characteristics and on its physical effect. After an introduction on sensors and types of sensors, this course introduces the main characteristics such as accuracy, precision, resolution, sensitivity, linearity, static and dynamic properties. The second part of the course details the main sensor effects and shows how sensor systems can be built based on such effects and used in engineering applications. The last part of the course shows current trends and advanced applications of sensor technology.

Course Outcomes

On successful completion, students will be able to

- understand the main sensor characteristics.
- read and understand a typical sensor data sheet.
- understand sensor effects.
- understand and characterize sensor platforms.
- select the appropriate sensor technology for a given application.

Contents

1. Introduction to Measurement Uncertainty
   - 1.1 Measurement Uncertainty
   - 1.2 Confidence Intervals
   - 1.3 Expression of Uncertainty
2. Sensors
   - 2.1 Sensors and Transducers
   - 2.2 Selection of Sensors
   - 2.3 Sensor Characteristics
   - 2.4 Measurement Systems and Components
3. Resistive Sensors
   - 3.1 Resistivity and Resistance

- 3.2 Potentiometric Sensors
- 3.3 Strain Gauges
- 3.4 Piezoresistive Sensors
- 3.5 Magnetoresistive Sensors
- 3.6 Thermoresistive Sensors
- 3.7 Optoresistive Sensors

4. Capacitive Sensors
   - 4.1 Capacitance and Permittivity
   - 4.2 Configurations
   - 4.3 Applications

5. Inductive and Magnetic Sensors
   - 5.1 Magnetic and Electromagnetic Quantities
   - 5.2 Magnetic Field Sensors
   - 5.3 Magnetic Displacement and Force Sensors
   - 5.4 Applications

6. Optical Sensors
   - 6.1 Electro-Optical Components
   - 6.2 Optical Displacement Sensors
   - 6.3 Applications

7. Piezoelectric Sensors
   - 7.1 Piezoelectricity
   - 7.2 Force Pressure and Acceleration Sensors
   - 7.3 Applications

8. Acoustic Sensors
   - 8.1 Acoustic Medium
   - 8.2 Measurement Methods
   - 8.3 Applications

9. Advanced Sensor Technology
   - 9.1 Organic Sensors
   - 9.2 Sensors for Health and Environment
   - 9.3 Wearable Sensors
   - 9.4 Wireless Sensors in Industrial Environments

Literature
Compulsory Reading
Further Reading ▪ Dertien, E., & Regtien, P. (2018). Sensors for mechatronics (2nd ed.). Elsevier. ▪ Lin, Y. L., Kyung, C. M., Yasuura, H., & Liu, Y. (Eds.) (2015). Smart sensors and systems. Springer International.

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	

Project: Sensors and Actors

Module Code: DLBAETWST2_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBROST01_E	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

N.N. (Project: Sensors and Actors)

Contributing Courses to Module

- Project: Sensors and Actors (DLBAETWST02_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

The aim of the course is to provide students with an in-depth insight into the sensor technology. The focus is on aspects of hardware, i.e. the typical components used for industrial sensors, as well as software aspects, in particular the processing and evaluation of sensor signals. This gives students a holistic and practical insight into the industrial application of sensor technology.

Learning Outcomes **Project: Sensors and Actors** On successful completion, students will be able to ▪ select hardware for the industrial use of sensors. ▪ design and calculate electrical circuits for processing sensor signals. ▪ develop algorithms for processing sensor signals. ▪ categorize current industrial issues in sensor technology and reproduce them.	
Links to other Modules within the Study Program This module is similar to other modules in the field of Engineering	**Links to other Study Programs of the University** All Bachelor Programs in the IT & Technology field

Project: Sensors and Actors

Course Code: DLBAETWST02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		n/a	DLBROST01_E

Course Description

The aim of the course is to provide students with a holistic insight into industrial sensor technology. Sensors fulfill important tasks in an industrial context. The course focuses on the design of sensors, sensor signal processing using electrical circuits and the evaluation of sensor signals using signal processing methods.

Course Outcomes

On successful completion, students will be able to

- select hardware for the industrial use of sensors.
- design and calculate electrical circuits for processing sensor signals.
- develop algorithms for processing sensor signals.
- categorize current industrial issues in sensor technology and reproduce them.

Contents

- As part of the course, the students independently work on a task from sensor technology. The components must be selected as well as the corresponding circuits for sensor signal processing must be designed. Furthermore, the corresponding signal processing is implemented by the students. A project report summarizes the results of these individual process steps for a specific task. The result is a holistic concept for a concrete industrial measurement task consisting of:
- The selection of a sensor to cope with the measurement task. Research on different measuring principles and selection of a measuring principle including a specific sensor type.
- The design and calculation of the electrical circuit for sensor signal processing.
- The design of the algorithms for the evaluation of the measurement data using automated signal processing in Python or Matlab.
- The aim is to provide a holistic and practical perspective on possible challenges in the everyday working life of engineers. The measurement tasks are:
- Geometric measurement technology: the surface of the manufactured component is to be tested in a machine tool.
- Image processing: Plastic injection-molded parts are to be automatically inspected for cavities and burrs.
- Mechanical measurands: Strain gauges are used to check the strength of a pipeline.
- Temperature measurement technology: The cooling of castings is to be monitored automatically.

- Measuring vibrations: A component of a motor vehicle is to be examined with regard to excitations from the environment.
- Measuring humidity: In an automotive supplier's plant in a tropical climate, the condition of the factory hall is to be continuously monitored.
- Optical metrology: The transparency of a material should be continuously monitored.
- Hardness measurement: Steel components are to be tested with regard to their mechanical strength and hardness.

Literature

Compulsory Reading

Further Reading

- Advances in intelligent sensors and IoT solutions. (2024). MDPI - Multidisciplinary Digital Publishing Institute.
- Berns, K., Köpper, A., & Schürmann, B. (2021). Basic electronic circuits (Vol. 732). Springer International Publishing.
- Fraden, J. (2016). Handbook of modern sensors [electronic resource]: physics, designs, and applications.
- Tiesinga, E. (2023). Units and constants. Springer International 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

Cloud Computing

Module Code: DLBDSCC

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 (Cloud Computing)

Contributing Courses to Module

- Cloud Computing (DLBDSCC01)

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

- Cloud computing fundamentals
- Relevant enabling technologies for cloud computing
- Introduction to serverless computing
- Established cloud platforms
- Cloud offerings for data science and analytics

Learning Outcomes

Cloud Computing

On successful completion, students will be able to

- understand the fundamentals of cloud computing and cloud service models.
- recognize enabling technologies that underlie current cloud offerings.
- cite the principles of serverless computing.
- analyze characteristics of established cloud offerings.
- describe cloud options for data science and machine learning

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

Cloud Computing

Course Code: DLBDSCC01

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

Course Description

Many of the recent advances in data science, particularly machine learning and artificial intelligence, rely on comprehensive data storage and computing power. Cloud computing is one way of providing that power in a scalable way, without considerable upfront investment in hardware and software resources. This course introduces the area of cloud computing together with its enabling technologies. Moreover, the most cutting-edge advances like serverless computing and storage are illustrated. Finally, a thorough overview on popular cloud offerings, especially in regard to analytics capabilities, is given.

Course Outcomes

On successful completion, students will be able to

- understand the fundamentals of cloud computing and cloud service models.
- recognize enabling technologies that underlie current cloud offerings.
- cite the principles of serverless computing.
- analyze characteristics of established cloud offerings.
- describe cloud options for data science and machine learning

Contents

1. Introduction to Cloud Computing
   - 1.1 Fundamentals of Cloud computing
   - 1.2 Cloud Service Models
   - 1.3 Benefits and Risks
2. Enabling Technology
   - 2.1 Virtualization and Containerization
   - 2.2 Storage Technology
   - 2.3 Networks and RESTful Services
3. Serverless Computing
   - 3.1 Introduction to Serverless Computing
   - 3.2 Benefits
   - 3.3 Limitations

4. Established Cloud Platforms
    - 4.1 General Overview
    - 4.2 Google Cloud Platform
    - 4.3 Amazon Web Services
    - 4.4 Microsoft Azure
    - 4.5 Platform Comparison

5. Data Science in the Cloud
    - 5.1 Provider-independent services and tools
    - 5.2 Google Data Science and Machine Learning Services
    - 5.3 Amazon Web Services Data Science and Machine Learning Services
    - 5.4 Microsoft Azure Data Science and Machine Learning Services

Literature

Compulsory Reading

Further Reading

- Goessling, S., & Jackson, K. L. (2018). Architecting cloud computing solutions. Packt Publishing.
- Mahmood, Z., Puttini, R., & Erl, T. (2013). Cloud computing: Concepts, technology & architecture. Prentice Hall.
- Sehgal, N. K., & Bhatt, P. C. P. (2023). Cloud computing with security and scalability: Concepts and practices.
- Zonooz, P., Farr, E., Arora, K., & Laszewski, T. (2018). Cloud native architectures. Packt Publishing.

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: Design for the Internet of Things

Module Code: DLBPDWDDAIT2_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBINGEIT01_E	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

(Project: Design for the Internet of Things)

Contributing Courses to Module

- Project: Design for the Internet of Things (DLBPDWDDAIT02_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

In this module, students are introduced to the technological foundations of the Internet of Things (IoT) and its social and economic importance. This is followed by the practical development of product concepts for a given topic area within the field of IoT.

Learning Outcomes

Project: Design for the Internet of Things

On successful completion, students will be able to

- actively integrate the capabilities of networked products into the design process.
- develop product concepts based on technology standards and network architectures of the Internet of Things.
- integrate sensors and actuators specifically into product concepts.
- create a customer journey map.
- communicate product concepts using a storyboard.

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

Project: Design for the Internet of Things

Course Code: DLBPDWDDAIT02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		5	DLBINGEIT01_E

Course Description

The Internet of Things (IoT) is bringing the design of hybrid products and holistic hardware, software and service experiences into the focus of design practice. Using a practical design project, students develop methodological skills in the design of networked products and product systems. The individual submission steps are accompanied by tutorials and provided with feedback.

Course Outcomes

On successful completion, students will be able to

- actively integrate the capabilities of networked products into the design process.
- develop product concepts based on technology standards and network architectures of the Internet of Things.
- integrate sensors and actuators specifically into product concepts.
- create a customer journey map.
- communicate product concepts using a storyboard.

Contents

- As part of the course, students develop a product or system concept for a given Internet of Things (IoT) application field. The focus is on designing the user experience and conceptualizing the associated technical system structure. The theoretical and basic technological knowledge of IoT that has been acquired is applied in practice. In addition, students develop methodological skills in researching, designing, and communicating user experiences that span several touchpoints.

Literature
Compulsory Reading
Further Reading ▪ Fattahi, A. (2022). IoT product design and development: Best practices for industrial, consumer, and business applications. Wiley. ▪ Heins, K. (2022). NB-IoT use cases and devices [electronic resource]: Design guide. ▪ Meruje, M., Samaila, M. G., Franqueira, V., Freire, M., & Inácio, P. R. M. (2020). A tutorial introduction to IoT design and prototyping with examples. John Wiley & Sons. ▪ Rowland, C., Goodman, E., Charlier, M., Light, A., & Lui, A. (2015). Designing connected products: UX for the consumer internet of things. O'Reilly Media, Inc. ▪ Reventlow, C. von, & Thesen, P. (2019). The digital shift. Steidl. ▪ Sterling, B. (2005). Shaping things. National Geographic Books.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Special Course

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

Advanced Data Analysis

Module Code: DLBDSEDA1

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 Zöller (Advanced Data Analysis)

Contributing Courses to Module

- Advanced Data Analysis (DLBDSEDA01)

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

- Business performance analytics
- Text mining
- Web- and social media analytics
- Experimentation and testing

Learning Outcomes

Advanced Data Analysis

On successful completion, students will be able to

- identify important design considerations for business KPIs.
- explain various topics in business process analytics.
- utilize established techniques for web data analytics.
- understand analytical approaches to text mining and semantic analysis.
- disambiguate relevant questions in social media analytics.
- use the techniques and methods for experimentation and testing.

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

Advanced Data Analysis

Course Code: DLBDSEDA01

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

Course Description

This course introduces several advanced analytics subjects of practical relevance. The subject areas covered span from business performance measurement and analytics, text mining, and web- and social media analytics to current trends in experimental design and setup. Along this journey topics such as the design of key performance indicators (KPIs), business process analytics, word frequency and semantic analysis, data science on clickstreams, social media interactions, and multi-armed bandit testing are addressed.

Course Outcomes

On successful completion, students will be able to

- identify important design considerations for business KPIs.
- explain various topics in business process analytics.
- utilize established techniques for web data analytics.
- understand analytical approaches to text mining and semantic analysis.
- disambiguate relevant questions in social media analytics.
- use the techniques and methods for experimentation and testing.

Contents

1. Business Performance Analytics
   - 1.1 KPI design considerations
   - 1.2 Common business performance indicators
   - 1.3 Business process mining
2. Text Analytics
   - 2.1 Word and document frequency (TF-IDF)
   - 2.2 Semantic analysis
3. Web Analytics
   - 3.1 Web metrics
   - 3.2 Clickstream analytics
   - 3.3 Recommender systems
4. Social Network Mining

4.1 Introduction to social media analytics
4.2 Mining common social media platforms

5. Testing and Experimentation
5.1 Practical A/B testing
5.2 Multivariate tests
5.3 Multi-armed bandit testing

Literature

Compulsory Reading

Further Reading

- Kaushik, A. (2009). Web analytics 2.0: The art of online accountability & science of customercentricity. Wiley.
- Lane, H., Howard, C., & Hapke, H. (2019). Natural language processing in action: Understanding, analyzing, and generating text with Python. Manning.
- Parmenter, D. (2019). Key performance indicators: Developing, implementing, and using winning KPIs (4th ed.). Wiley.
- Russell, M. A., & Klassen, M. (2019). Mining the social web: Data mining Facebook, Twitter, Linkedin, Instagram, Github, and more (3rd ed.). O'Reilly.
- Siroker, D., & Koomen, P. (2013). A/B testing: The most powerful way to turn clicks into customers. 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	☑ 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: Data Analysis

Module Code: DLBDSEDA2

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. Frank Passing (Project: Data Analysis)

Contributing Courses to Module

- Project: Data Analysis (DLBDSEDA02)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

Transfer of methodological knowledge to the implementation of real-world analytics use cases from the above-mentioned problem domains.

Learning Outcomes

Project: Data Analysis

On successful completion, students will be able to

- formulate and implement a real-world analytical use case.
- analyze the suitability of different possible approaches with respect to the project task.
- transfer acquired specialized analytical knowledge to real-world use cases.
- derive relevant design choices from the given project setting.
- make apposite choices with respect to implementation alternatives.
- select appropriate resources

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

Project: Data Analysis

Course Code: DLBDSEDA02

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, advanced analytics use case in the form of a student project. Primary subject areas for this practical work include business performance analytics, text mining, web- and social analytics, and experimentation and testing.The goal is for students to demonstrate they can transfer the theoretical knowledge acquired in Advanced Data Analysis (DLBDSEDA01) to an implementation scenario that closely mimics project work in a professional data science setting.

Course Outcomes

On successful completion, students will be able to

- formulate and implement a real-world analytical use case.
- analyze the suitability of different possible approaches with respect to the project task.
- transfer acquired specialized analytical knowledge to real-world use cases.
- derive relevant design choices from the given project setting.
- make apposite choices with respect to implementation alternatives.
- select appropriate resources

Contents

- This course covers the practical implementation of the approaches and techniques covered in the course Advanced Data Analysis (DLBDSEDA01) in a project-oriented setting. Each participant must produce a project report detailing and documenting their work. Project tasks are chosen from a list or suggested by the students in accord with the tutor.

Literature

Compulsory Reading

Further Reading

- Hapke, H., Howard, C., & Lane, H. (2019). Natural language processing in action. Manning Publications.
- Klassen, M., & Russell, M. A. (2019). Mining the social web (3rd ed.). O'Reilly Media.
- Ojeda, T., Bilbro, R., & Bengfort, B. (2018). Applied text analysis with Python. O'Reilly Media.
- Parmenter, D. (2020). Key performance indicators: Developing, implementing, and using winning KPIs (3rd ed.). John Wiley & Sons.

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 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

Data Engineering

Module Code: DLBDSEDE1

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

Sahar Qaadan (Data Engineering)

Contributing Courses to Module

- Data Engineering (DLBDSEDE01)

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

- Core concepts of data engineering and data-intensive applications
- Current storage technology and architectural patterns for data at scale
- Container technology
- Operational aspects of data pipelines
- Data security and protection

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.

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

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

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

Exam Preparation
- ☑ Practice Exam
- ☑ Online Tests

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

Module Code: DLBDSEDE2

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

Sahar Qaadan (Project: Data Engineering)

Contributing Courses to Module

- Project: Data Engineering (DLBDSEDE02)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

Transfer of methodological knowledge to the implementation of real-world data engineering use cases from the above-mentioned problem domains.

Learning Outcomes

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 of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

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

Project: AI Excellence with Creative Prompting Techniques

Module Code: DLBPKIEKPT1_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. Knut Linke (Project: AI Excellence with Creative Prompting Techniques)

Contributing Courses to Module

- Project: AI Excellence with Creative Prompting Techniques (DLBPKIEKPT01_E)

Module Exam Type

Module Exam	Split Exam
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

In this module, the students delve into the world of generative AI applications, creating AI-generated content like text, images, and videos, while learning to use, analyze, and evaluate these systems in their respective study fields.

Learning Outcomes

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

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

Project: Generative AI in an Enterprise Context

Module Code: DLBFMPGKIU_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

N.N. (Project: Generative AI in an Enterprise Context)

Contributing Courses to Module

- Project: Generative AI in an Enterprise Context (DLBFMPGKIU01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

In this course, students gain in-depth knowledge on the fundamentals, development, and implementation of generative AI technologies. They learn to critically analyze the potential of generative AI, plan actionable AI projects, and understand the associated social and ethical implications. The practical implementation of their own AI projects promotes a thorough knowledge of the application possibilities of AI systems in both business and societal contexts.

Learning Outcomes

Project: Generative AI in an Enterprise Context

On successful completion, students will be able to

- understand and apply key concepts, algorithms, and tools used for generative AI applications to develop independent AI-based solutions.
- systematically identify the possibilities and potentials of generative AI in various business areas and company functions, and evaluate them for feasibility and strategic relevance.
- create a roadmap for the implementation of a generative AI solution, including resource planning, risk assessment, and milestones.
- develop criteria and methods for evaluating generative AI projects, including quantitative and qualitative KPIs and ROI analyses.
- recognize and address ethical, legal, and data privacy issues when dealing with generative AI technologies.

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

Project: Generative AI in an Enterprise Context

Course Code: DLBFMPGKIU01_E

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

Course Description

The course places the transformative power of generative Artificial Intelligence (AI) in the landscape of modern businesses. It offers a strategic insight into the application of AI technologies to solve complex business challenges and create new business opportunities. At the same time, the course emphasizes the essential role generative AI can play in the context of societal responsibility and social welfare. Students gain insights into the dynamics between technological development and economic value, which is fundamental for future-oriented businesses. The course agenda aims to enable students to act as frontrunners in the adoption of AI solutions and to sustainably anchor these in corporate structures. They recognize the significance of generative AI as a catalyst for innovation and efficiency increase and learn how to use this leverage profitably for business models and company processes. Through working on practical case studies, students not only acquire valuable technical skills but also strategic competencies that are necessary for the evaluation and implementation of AI-driven business plans. The central element of the course is the creation of an AI prototype that consolidates the knowledge learned and provides forward-looking solutions for businesses

Course Outcomes

On successful completion, students will be able to

- understand and apply key concepts, algorithms, and tools used for generative AI applications to develop independent AI-based solutions.
- systematically identify the possibilities and potentials of generative AI in various business areas and company functions, and evaluate them for feasibility and strategic relevance.
- create a roadmap for the implementation of a generative AI solution, including resource planning, risk assessment, and milestones.
- develop criteria and methods for evaluating generative AI projects, including quantitative and qualitative KPIs and ROI analyses.
- recognize and address ethical, legal, and data privacy issues when dealing with generative AI technologies.

Contents

- In this course, students gain a deep understanding of generative AI technologies and their application in the business context. This allows them to independently develop appropriate solutions. Core areas enable participants to focus on identifying relevant algorithms, use tools and development environments efficiently, and grasp their strategic significance within individual business processes.
- Students are simultaneously encouraged to reflect on the societal impacts of their developments and understand generative AI as a tool for societal progress. Participants independently explore the possibilities that generative AI offers in areas such as financial management, marketing, and logistics, and investigate how these technologies can expand or redesign existing processes.
- Particular value is placed on independent assessment of feasibility, ethical considerations, and compliance with data protection regulations. The self-guided development of a roadmap for an AI project includes defining goals and milestones and setting up and monitoring performance indicators (KPIs).
- Students analyze what resources are needed, how risks can be managed, and how the success of the implemented AI solution can be measured and interpreted. Finally, participants create a prototype that implements the insights gained and supports the chosen business function through the use of generative AI.
- With a project-oriented approach, students develop an awareness that technological advances must always be in line with societal responsibility and ethical standards.

Literature

Compulsory Reading

Further Reading

- Dencik, J., Goehring, B., & Marshall, A. (2023). Managing the emerging role of generative AI in next-generation business. Strategy & Leadership, 51(6), 30–36.
- Hirsch, P. B. (2023). At the crossroads: generative AI and corporate risk management. Journal of Business Strategy, 44(6), 426–429.
- Humphreys, D., Koay, A., Desmond, D., & Mealy, E. (2024). AI hype as a cyber security risk: the moral responsibility of implementing generative AI in business. AI and Ethics, 1–14.
- Kulkarni, A., Shivananda, A., Kulkarni, A., & Gudivada, D. (2023). LLMs for Enterprise and LLMOps. Apress.
- Obrenovic, B., Gu, X., Wang, G., Godinic, D., & Jakhongirov, I. (2024). Generative AI and human–robot interaction: implications and future agenda for business, society and ethics. AI & SOCIETY: Journal of Knowledge, Culture and Communication, 1–14.

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

Negotiation Techniques

Module Code: DLBKPSGUV_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

(Negotiation Techniques)

Contributing Courses to Module

- Negotiation Techniques (DLBKPSGUV01_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

- Definition of trust and empathy in conversations
- Conflict escalation and moderation techniques
- The psychology of negotiation
- Practical examples at different negotiation levels

Learning Outcomes

Negotiation Techniques

On successful completion, students will be able to

- apply methods of conducting discussions.
- create an atmosphere of trust in a conversation using the tools discussed.
- assess the effectiveness of various negotiation techniques.
- use the appropriate negotiation techniques in various settings
- apply negotiation techniques in practice.

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 Psychology	All Bachelor Programs in the Social Sciences field

Negotiation Techniques

Course Code: DLBKPSGUV01_E

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

Course Description

From partnerships to international negotiations: whenever people with different interests and needs come together, the potential for conflict arises. This is why the art of conversation promises various advantages: on the one hand, this skill enables you to understand your counterpart and resolve potential conflicts through empathetic communication. On the other hand, skillful negotiation tactics offer the advantage of asserting one's own interests and achieving win-win solutions. Both perspectives are covered in this course: It starts by looking at measures for creating an atmosphere of trust in discussions, for example through empathy and active listening. It also leads through various phases of conflict resolution and highlights the associated challenges. The second part introduces negotiation methods such as the Harvard concept and discusses their effectiveness using practical examples at both an individual and political level.

Course Outcomes

On successful completion, students will be able to

- apply methods of conducting discussions.
- create an atmosphere of trust in a conversation using the tools discussed.
- assess the effectiveness of various negotiation techniques.
- use the appropriate negotiation techniques in various settings
- apply negotiation techniques in practice.

Contents

1. Basic Principles of Conversations and Negotiations
    - 1.1 Influencing Factors of Conversations and Negotiations
    - 1.2 Participants in Conversations
    - 1.3 Conversation Process and Interaction
    - 1.4 Occasions for Conversation
2. Creating an Atmosphere of Trust in Conversations
    - 2.1 Definition of Trust
    - 2.2 Empathy
    - 2.3 Active Listening
3. Resolving Conflicts

3.1 Definition of Conflict/Conflict Levels
3.2 Conflict Escalation according to Glasl
3.3 Conflict Moderation

4. The Psychology of Negotiations
4.1 Definitions
4.2 Cognitive Approaches to Negotiation Research
4.3 Motivational Approaches to Negotiation Research

5. The Harvard Concept
5.1 Basic Principles of the Concept
5.2 Critical Analysis and Alternatives

6. Exercises and Application Examples
6.1 Practice of Active Listening
6.2 Practice of Conflict Moderation
6.3 Practice of Negotiation

Literature

Compulsory Reading

Further Reading

- Fisher, R., Ury, W., & Patton, B. (2012). *Getting to yes: Negotiating an agreement without giving in* (3rd ed., rev. ed.) [E-book]. Random House Business Books.
- Kerns, C. (2016). Managing and negotiating conflict: A key managerial leadership practice. *International Leadership Journal, 8* (2), 74–98.
- Proksch, S. (2016). *Conflict management* [E-book]. Springer.
- Rosenberg, M. B., & Chopra, D. (2015). *Nonviolent communication: A language of life: Life-changing tools for healthy relationships* (3rd ed.) [E-book]. PuddleDancer Press.
- Tjosvold, D., Wong, A. S. H., & Chen, N. Y. F. (2019). Managing conflict for effective leadership and organizations. In *Oxford research encyclopedia of business and management*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190224851.013.240

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
☑ Recorded Live Sessions	☑ Audio	☑ Online Tests
	☑ Slides	

Organizational Behavior

Module Code: DLBBWOB_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. Katharina Rehfeld (Organizational Behavior)

Contributing Courses to Module

- Organizational Behavior (DLBBWOB01_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

- Relevance and Importance of Organizational Behavior
- Job Performance
- Commitment
- Organisational Mechanisms
- Group-Related Mechanisms
- Individual Mechanisms
- Individual Characteristics

Learning Outcomes

Organizational Behavior

On successful completion, students will be able to

- establish commitment and performance as the critical dependent variables.
- explain organizational, group-related and individual mechanisms in Organizational Behavior and describe their relation to commitment and performance.
- explain the influence of individual characteristics on individual mechanisms (such as satisfaction, stress, motivation, trust and decision-making).

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 Programmes in the Human Resources field

Organizational Behavior

Course Code: DLBBWOB01_E

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

Course Description

Many decisions are not made solely on the basis of financial or revenue-based considerations, but due to personal agendas, personal preferences or internal competition. This course consequently aims to provide an accessible, theory-driven comprehension of behaviour, interactions and conflicts in organisations. The course deals intensively with the psychological, sociological and anthropological foundations and dynamics in organizations. Starting from the two most critical behavioral variables in the work context, performance and commitment, units and settings that have a significant influence on them are discussed. In detail, organizational, group-related and individual mechanisms as well as individual characteristics are explored as explanatory objects.The course continues with a discussion on corporate culture and organisational structure within the framework of the organisational mechanisms. In the context of group-related mechanisms, the course aims to identify aspects of leadership styles, power structures, negotiation strategies, group dynamics and heterogeneity. Individual mechanisms include job satisfaction, stress, motivation, fairness, trust and decision-making. The individual characteristics (abilities and personality) in turn have an effect on these aforementioned elements.

Course Outcomes

On successful completion, students will be able to

- establish commitment and performance as the critical dependent variables.
- explain organizational, group-related and individual mechanisms in Organizational Behavior and describe their relation to commitment and performance.
- explain the influence of individual characteristics on individual mechanisms (such as satisfaction, stress, motivation, trust and decision-making).

Contents

1. Introduction to Organizational Behavior
    - 1.1 Attitudes and Behavior as Determinants of Performance and Commitment
    - 1.2 Organizational Mechanisms
    - 1.3 Group-related Mechanisms
    - 1.4 Individual Characteristics
    - 1.5 Individual Mechanisms
2. Target Figures: Performance and Commitment

2.1 Performance
2.2 Commitment

3. Organizational Mechanisms
   3.1 Corporate Structure
   3.2 Corporate Culture

4. Group-Related Mechanisms
   4.1 Management Styles
   4.2 Power Structures
   4.3 Negotiation Strategies
   4.4 Team Dynamics
   4.5 Diversity

5. Individual Characteristics
   5.1 Skill and Intellect
   5.2 Personality

6. Individual Mechanisms
   6.1 Job Satisfaction
   6.2 Stress
   6.3 Motivation
   6.4 Trust
   6.5 Integrity
   6.6 Learning and Decision-Making

Literature

Compulsory Reading

Further Reading

- Colquitt, J., Lepine, J. A., & Wesson, M. J. (2018). Organizational behavior: Improving performance and commitment in the workplace (6th ed.). McGraw-Hill Irwin.
- Cross, C., & Carbery, R. (2016). Organizational behavior: An introduction. Macmillan Education.
- Luthans, F., Luthans, B. C., & Luthans, K. W. (2015). Organizational behavior: An evidence-based approach (13th ed.). Information Age Publishing.
- Robins, S. P., & Judge, T. A. (2016). Organizational behavior. Prentice Hall International.

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
	☑ 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
	☑ Audio	
	☑ Slides	

Studium Generale I

Module Code: DLBSG1_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

N.N. (Studium Generale I)

Contributing Courses to Module

- Studium Generale I (DLBSG01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: myStudies See Selected Course Study Format: Distance Learning See Selected Course	

Weight of Module

see curriculum

Module Contents

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.

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

Module Code: DLBSG2_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

N.N. (Studium Generale II)

Contributing Courses to Module

- Studium Generale II (DLBSG02_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning See Selected Course Study Format: myStudies See Selected Course	

Weight of Module

see curriculum

Module Contents

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 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 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

Project: Software Development with AI

Module Code: DLBSEPPSD-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

(Project: Software Development with AI)

Contributing Courses to Module

- Project: Software Development with AI (DLBSEPPSD01-01_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 building on the subject-specific study components to gain practical experience in the field of AI-supported software development. For this purpose any software is to be implemented, e.g. a comprehensive smartphone app, a web application or a set of microservices hosted in the cloud, which together fulfill a complex business need. In principle, the Software should be able to solve a relevant practical problem be able to solve. Students should demonstrate how they have used AI-based code generation Tools to develop the solution.

Learning Outcomes

Project: Software Development with AI

On successful completion, students will be able to

- identify relevant problems from the professional environment of software developers and explain them to an interested audience.
- apply established procedures with the help of AI-supported code generation to find a software-based solution to a problem.
- identify relevant technologies, programming languages and software libraries for the solution and to put the software into operation in a suitable infrastructure suitable infrastructure.
- evaluate the Output with regard to its suitability for solving the practical problem.
- present the problem, the solution and the way to get there in an understandable and clear way in an understandable and clear 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 fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology field

Project: Software Development with AI

Course Code: DLBSEPPSD01-01_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 developers and explain them to an interested audience.
- apply established procedures with the help of AI-supported code generation to find a software-based solution to a problem.
- identify relevant technologies, programming languages and software libraries for the solution and to put the software into operation in a suitable infrastructure suitable infrastructure.
- evaluate the Output with regard to its suitability for solving the practical problem.
- present the problem, the solution and the way to get there in an understandable and clear way in an understandable and clear 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:** 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

Internship: Computer Science & Business Information Systems

Module Code: DLBITPIWI_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	30	900 h

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

Module Coordinator

(Internship: Computer Science & Business Information Systems)

Contributing Courses to Module

- Internship: Computer Science & Business Information Systems (DLBITPIWI01_E)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Reflection of Practical Experiences (passed / not passed) Study Format: myStudies Reflection of Practical Experiences (passed / not passed)	

Weight of Module

see curriculum

Module Contents

Within the framework of this internship, students document and reflect on their everyday practical experiences. This is based on knowledge they have acquired. Students now apply this theoretical knowledge in various fields of practice and reflect upon it.

Learning Outcomes

Internship: Computer Science & Business Information Systems

On successful completion, students will be able to

- transfer theoretical knowledge to practical problems.
- depending on the tasks undertaken, independently address and manage practical challenges; to reflect on their success.
- better assess the scope, significance, and limitations of theoretical concepts in light of practical demands.

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

Internship: Computer Science & Business Information Systems

Course Code: DLBITPIWI01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
BA	English		30	none

Course Description

Within the scope of this course, students document and reflect on their everyday practical experience, relating it to the subject-specific and related scientific knowledge bases they have previously learned and developed, as well as previously acquired skills and competencies for action. The students apply their theoretical knowledge in various practical fields and reflect upon it. The connection between theory and practice, the application of knowledge in the practical field, and the reflection of these experiences in relation to theory and personal development are the primary focus.

Course Outcomes

On successful completion, students will be able to

- transfer theoretical knowledge to practical problems.
- depending on the tasks undertaken, independently address and manage practical challenges; to reflect on their success.
- better assess the scope, significance, and limitations of theoretical concepts in light of practical demands.

Contents

- As part of the internship, students document and reflect on their everyday professional experiences in the field of Business Information Systems. The individual problems and questions that arise are reflected upon from the perspective of professional practice. This module provides students with the opportunity to apply the content they have learned in previous modules through practical reflection and to directly implement practical knowledge where it has been acquired. Various concepts and methods are concretely tested in practice and reflected upon in their specific applications. The basis for this is the documentation, evaluation, and presentation of approaches and methods in the chosen context of action.

Literature
Compulsory Reading
Further Reading ▪ Within the subject relation, the literature of each module in the program is relevant.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Reflection (of Practical Work) / Group Reflection

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Reflection of Practical Experiences (passed / not passed)

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
0 h	0 h	0 h	0 h	900 h	900 h

Instructional Methods

Study Format myStudies

Study Format	Course Type
myStudies	Reflection (of Practical Work) / Group Reflection

Information about the examination	
Examination Admission Requirements	**Online Tests:** no
Type of Exam	Reflection of Practical Experiences (passed / not passed)

Student Workload					
Self Study	**Contact Hours**	**Tutorial/Tutorial Support**	**Self Test**	**Independent Study**	**Hours Total**
0 h	0 h	0 h	0 h	900 h	900 h

Instructional Methods

Intercultural and Ethical Decision-Making

Module Code: DLBCSIDM

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. Zeljko Sevic (Intercultural and Ethical Decision-Making)

Contributing Courses to Module

- Intercultural and Ethical Decision-Making (DLBCSIDM01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Basics of Intercultural Competence
- Cultural Concepts
- Culture and Ethics
- Implications of Current Ethical Problems in the Area of Interculturality, Ethics, and Diversity
- Intercultural Learning and Working
- Case Studies for Cultural and Ethical Conflicts

Learning Outcomes

Intercultural and Ethical Decision-Making

On successful completion, students will be able to

- explain the most important terms in the areas of interculturality, diversity, and ethics.
- distinguish different explanatory patterns of culture.
- understand culture at different levels.
- plan processes of intercultural learning and working.
- understand the interdependencies of culture and ethics.
- independently work on a case study on intercultural competence.

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

Intercultural and Ethical Decision-Making

Course Code: DLBCSIDM01

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

Course Description

In this course, students acquire the necessary knowledge to understand intercultural competencies and current developments in the fields of diversity and ethics. Students will understand how to systematically plan and implement learning processes for the development of competences important in these areas. First, important terms are clarified and differentiated from each other, and cultural aspects are explained from different perspectives. In addition, students learn that cultural issues are relevant at different levels, for example, within a state, company, or other group. In this context, students also recognize the connection between ethics and culture with different interdependencies. On the basis of this knowledge, students are then familiarized with the different possibilities and potentials of intercultural and ethical learning and working. Practical cases are used to illustrate the importance of the relationships learned for today's work context in many companies. The students then work on a case study in which the acquired knowledge is systematically applied.

Course Outcomes

On successful completion, students will be able to

- explain the most important terms in the areas of interculturality, diversity, and ethics.
- distinguish different explanatory patterns of culture.
- understand culture at different levels.
- plan processes of intercultural learning and working.
- understand the interdependencies of culture and ethics.
- independently work on a case study on intercultural competence.

Contents

1. Basics of Intercultural and Ethical Competence to Act
    - 1.1 Subject Areas, Terms, and Definitions
    - 1.2 Relevance of Intercultural and Ethical Action
    - 1.3 Intercultural Action - Diversity, Globalization, Ethics
2. Cultural Concepts
    - 2.1 Hofstedes Cultural Dimensions
    - 2.2 Culture Differentiation According to Hall
    - 2.3 Locus of Control Concept to Rotter

3. Culture and Ethics
   - 3.1 Ethics - Basic Terms and Concepts
   - 3.2 Interdependence of Culture and Ethics
   - 3.3 Ethical Concepts in Different Regions of the World

4. Current Topics in the Area of Interculturality, Ethics, and Diversity
   - 4.1 Digital Ethics
   - 4.2 Equality and Equal Opportunities
   - 4.3 Social Diversity

5. Intercultural Learning and Working
   - 5.1 Acculturation
   - 5.2 Learning and Working in Intercultural Groups
   - 5.3 Strategies for Dealing with Cultural Conflicts

6. Case Studies for Cultural and Ethical Conflicts
   - 6.1 Case Study: Interculturality
   - 6.2 Case Study: Diversity
   - 6.3 Case Study: Interculturality and Ethics

Literature

Compulsory Reading

Further Reading

- Al-Ali, E., & Masmoudi, M. (2023). Leadership and Workplace Culture in the Digital Era. Business Science Reference.
- Barmeyer, C., Bausch, M., & Mayrhofer, U. (2021). Constructive Intercultural Management.
- Berrones-Flemmig, N., Contreras, F., & Dornberger, U. (2022). Business in the 21st century: A sustainable approach (1st ed.). Emerald Publishing Limited.
- Rossouw, J., & Van Vuuren, L. (2017). Business ethics (6th ed.). Oxford University Press Southern Africa.

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	☑ 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	☑ 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	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	☑ 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
- ☑ 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	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

Computer Science and Society

Module Code: DLBCSCSAS

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. Janki Dodiya (Computer Science and Society)

Contributing Courses to Module

- Computer Science and Society (DLBCSCSAS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- The role of computer science
- The impact of the information society on the economy and society
- Infrastructure vulnerability
- Informatics and the military
- Responsibility in Information Technology

Learning Outcomes

Computer Science and Society

On successful completion, students will be able to

- name significant stages of development in computer science and the Internet.
- describe the role of computer science as a science and its relation to other sciences.
- explain and discuss the main economic and social implications of the information society.
- explain and discuss the causes and effects of infrastructure vulnerability.
- discuss and apply relevant ethical principles to issues in computer 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 Computer Science & Software Development.	All Bachelor Programs in the IT & Technology field.

Computer Science and Society

Course Code: DLBCSCSAS01

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

Course Description

Computer science is a science that shapes society in a special way, and thus has a significant impact on society. Depending on its application and prevailing conditions, it can help to improve society and living conditions or cause and exacerbate surveillance, unemployment, and other social problems. In many cases, it is not the results of computer science itself that are "good" or "bad", but the results can be used to serve very different purposes ("dual use"). In this module students acquire the basic tools to understand the effects of computer science in general and its effects on their everyday work as a data scientist.

Course Outcomes

On successful completion, students will be able to

- name significant stages of development in computer science and the Internet.
- describe the role of computer science as a science and its relation to other sciences.
- explain and discuss the main economic and social implications of the information society.
- explain and discuss the causes and effects of infrastructure vulnerability.
- discuss and apply relevant ethical principles to issues in computer science.

Contents

1. Introduction
   - 1.1 Computer Science, Society, and the Information Society
   - 1.2 Historical Overview of Computer Science and the Internet
   - 1.3 What is Computer Science?
   - 1.4 Relevant Organizations
2. The Role of Data in the Information Society
   - 2.1 Data as a Commodity
   - 2.2 Data Protection and Data Spying
   - 2.3 Long-Term Archiving
3. Economic Impacts of the Information Society
   - 3.1 Globalization and the Formation of Monopolies in the Economy
   - 3.2 Open Movement

- 3.3 Change in the Labor Market
- 3.4 Intellectual Property

4. Social impacts of the Information Society
   - 4.1 Social Networks
   - 4.2 Surveillance
   - 4.3 Digitization of Education
   - 4.4 Women in Computer Science

5. Infrastructure Vulnerability
   - 5.1 Attacks and Accidents
   - 5.2 Technical Infrastructure
   - 5.3 Political and Social Infrastructure

6. Computer Science and the Military
   - 6.1 Military as the Driver of Computer Science
   - 6.2 Cyber War
   - 6.3 Dual Use

7. Responsibility in Computer Science
   - 7.1 Ethics of Responsibility According to Jonas
   - 7.2 Ethical Guidelines for Computer Science in Society
   - 7.3 Decision-making by Algorithms
   - 7.4 Mechanisms for Implementing Responsibility in Computer Science

Literature
Compulsory Reading
Further Reading ▪ Clegg, B. (2017): Big Data. How the Information Revolution is Transforming Our Lives. Icon 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	Written Assessment: Written 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	☑ 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	Written Assessment: Written 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	☑ Audio	
	☑ Slides	

Digital Business Models

Module Code: DLBLODB_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. Muhammad Ashfaq (Digital Business Models)

Contributing Courses to Module

- Digital Business Models (DLBLODB01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- 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

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.

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 Business Administration and Management field	All Bachelor Programmes in the Business & Management field

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

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	

Project: Digitalization and Automation Hackathon

Module Code: DLBCCOEDAH

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

(Project: Digitalization and Automation Hackathon)

Contributing Courses to Module

- Project: Digitalization and Automation Hackathon (DLBCCOEDAH01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

The Project: Digitalization and Automation Hackathon offers students the opportunity to gain practical experience in the field of Digitalization and Automation. The objective is to create a working Digitalization or Automation solution, which can include various elements such as no-code/low-code development, cloud computing, (web) applications, AI applications, AI modeling, or industrial programming. The solution should address a real-world problem encountered in practice.

Learning Outcomes

Project: Digitalization and Automation Hackathon

On successful completion, students will be able to

- identify relevant problems from the professional environment and explain it to an interested audience .
- apply established procedures to find a (prototypical) solution to the problem.
- understand relevant concepts or technologies for the solution and integrate them appropriately.
- evaluate the result with respect to its suitability for solving the practical problem.
- present the problem, the solution and the way to get there in a comprehensible and descriptive way.
- communicate in a group, solving conflicts and negotiating on responsibility scope, and collaborating with students from diverse backgrounds or work individually taking responsibility for all details, reflecting on tutorial feedback.

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: Digitalization and Automation Hackathon

Course Code: DLBCCOEDAH01

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

Course Description

The Hackathon module, designed to provide an immersive and hands-on experience for students across all Bachelor's degree programs in the field of Computer Science and Information Technology, aims to foster creativity, collaboration, and problem-solving skills by engaging students in diverse project challenges. Throughout the module, students will have the opportunity to work in teams, apply their theoretical knowledge, and showcase their practical skills to address real-world problems. For this purpose, a working digitalization or automation solution is to be created. It can include various elements such as no-code/low-code development, cloud computing, (web) applications, AI applications, AI modeling, or industrial programming. The solution should address a real-world problem encountered in practice.

Course Outcomes

On successful completion, students will be able to

- identify relevant problems from the professional environment and explain it to an interested audience .
- apply established procedures to find a (prototypical) solution to the problem.
- understand relevant concepts or technologies for the solution and integrate them appropriately.
- evaluate the result with respect to its suitability for solving the practical problem.
- present the problem, the solution and the way to get there in a comprehensible and descriptive way.
- communicate in a group, solving conflicts and negotiating on responsibility scope, and collaborating with students from diverse backgrounds or work individually taking responsibility for all details, reflecting on tutorial feedback.

Contents

- At the beginning of the hackathon, students choose a specific task from the given examples in coordination with the tutor. The task should be derived from a relevant practical problem. Possible problems and use cases can be found in areas such as sustainability, smart factories, robotics, smart homes, electromobility, autonomous driving, human-machine interaction, data analytics, robotic process automation, or digital business models. Depending on the study program, the tutor should approve use cases of similar complexity based on their subject matter expertise. Students work on the task using a prototyping environment that is suitable for the subject of the task. The environments can be

hardware, such as prototyping boards like Arduino, or software, such as technology-specific development environments like Matlab, Eclipse IDE, VS Code, Jupyter Notebook/Google Colab, or public cloud platforms. To complete the task, students apply the concepts, methods, and tools taught throughout the curriculum. The project results will be presented; additionally, the students are asked to publish the results, along with the underlying problem and chosen solution, on a platform so that they can be seen by other students. The results are evaluated in terms of their suitability to solve the previously selected problem. Aspects such as complexity, creativity, and practical relevance also play a role.

Literature

Compulsory Reading

Further Reading

- Knaflic, C. N. (2015). Storytelling with Data: A Data Visualization Guide for Business Professionals. Wiley.
- Ries, E. (2011). The Lean Startup. Crown Business.
- Swaminathan, A., & Meffert, J. (2017). Digital @ Scale: The Playbook You Need to Transform Your Company. PublicAffairs.
- Sweigart, A. (2015). Automate the Boring Stuff with Python. No Starch Press.
- Van Der Pijl, P., Lokitz, J., & Wijnen, R. (2016). Design a Better Business. Wiley.

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

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
Exam Preparation ☑ Review Book

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
Exam Preparation ☑ Review Book

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