

MODULE HANDBOOK

Master of Science

Master DevOps and Cloud Computing (FS-OI-EU-MADCC-120)

120 CP

Distance Learning

Classification: Consecutive

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1. Semester

Agile Software Development Techniques and Methods

Module Code: DLMIWNF1_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Damir Ismailovic (Agile Software Development Techniques and Methods)

Contributing Courses to Module

- Agile Software Development Techniques and Methods (DLMIWNF01_E)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Case Study

Split Exam

Weight of Module

see curriculum

Module Contents

- Features and principles of agility
- Agility in small teams with Scrum
- Agile portfolio and project management
- Agile requirements and IT architecture management
- Agile Testing
- Agile Delivery und Deployment

Learning Outcomes**Agile Software Development Techniques and Methods**

On successful completion, students will be able to

- analyze and assess problems and risks of industrial software development and their consequences for development processes.
- know and understand the basic principles of agile software engineering.
- analyze practical scenarios and independently apply suitable methods and tools of agile software engineering.

Links to other Modules within the Study Program

This module is similar to other modules in the fields of Computer Science & Software Development

Links to other Study Programs of the University

All Master Programs in the IT & Technology fields

Agile Software Development Techniques and Methods

Course Code: DLMIWNF01_E

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

Course Description

Agile software development means simplifying software processes by concentrating on the main activities and implementing them with pragmatic principles of software engineering. This course provides an overview of the topic and differentiates agile software development from plan-driven development processes. In addition, the course teaches which mixture of techniques and procedures from agile and plan-driven software development is best suited for which situations.

Course Outcomes

On successful completion, students will be able to

- analyze and assess problems and risks of industrial software development and their consequences for development processes.
- know and understand the basic principles of agile software engineering.
- analyze practical scenarios and independently apply suitable methods and tools of agile software engineering.

Contents

1. Features 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 and General Setup with Scrum
 - 2.2 Central Management Artifact: Product Backlog
 - 2.3 Other Management Artifacts
3. Agile Portfolio and 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 IT Architecture Management
 - 4.1 Requirements Engineering in Agile Projects
 - 4.2 Architecture Management in Agile Projects
5. Agile Testing
 - 5.1 Basics and Requirements for the QA Organization
 - 5.2 Testing Levels and Agility
 - 5.3 Test Automation
6. Agile Delivery and Deployment
 - 6.1 Basics and Continuous Delivery Pipeline
 - 6.2 Continuous Build and Continuous Integration
 - 6.3 Acceptance Tests, Load Tests and Continuous Deployment

Literature**Compulsory Reading****Further Reading**

- Cockburn, A. (2007). Agile software development: The cooperative game (2nd ed.). Addison-Wesley.
- Crispin, L. (2008). Agile testing: A practical guide for testers and Agile teams. Addison-Wesley.
- Highsmith, J. (2009). Agile project management: Creating innovative products. Addison-Wesley.
- Rubin, K. S. (2012). Essential Scrum: A practical guide to the most popular Agile process. Addison-Wesley.
- Schwaber, K. (2014). Agile project management with Scrum. Microsoft Press.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

IT Service Management

Module Code: DLMBITGSM1

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. André Köhler (IT Service Management)

Contributing Courses to Module

- IT Service Management (DLMBITGSM01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Exam, 90 Minutes

Study Format: myStudies
Exam, 90 Minutes

Split Exam

Weight of Module

see curriculum

Module Contents

- IT infrastructure library (ITIL)
- ITIL service strategy
- ITIL service design
- ITIL service transition
- ITIL service operation

Learning Outcomes**IT Service Management**

On successful completion, students will be able to

- understand IT service management as the enabler of information technology strategies and operations objectives.
- define the touchpoints between IT service management and management information systems.
- differentiate between lightweight and heavyweight approaches to IT service management.
- understand benchmarks and assessments to measure the capability of a service provider and its IT service management competences.
- apply IT services management tools and platforms proactively based on current information technology research and advisory.

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 Master Programmes in the IT & Technology field.

IT Service Management

Course Code: DLMBITGSM01

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

Course Description

This course focuses on the nature and practice of IT services that keep IT systems running. It introduces students to the knowledge and experience needed to provide IT as a service to organizations, mainly based on the IT Infrastructure Library (ITIL) which is the industry standard for this purpose.

Course Outcomes

On successful completion, students will be able to

- understand IT service management as the enabler of information technology strategies and operations objectives.
- define the touchpoints between IT service management and management information systems.
- differentiate between lightweight and heavyweight approaches to IT service management.
- understand benchmarks and assessments to measure the capability of a service provider and its IT service management competences.
- apply IT services management tools and platforms proactively based on current information technology research and advisory.

Contents

1. Introduction to IT Service Management
 - 1.1 IT Services, Business IT Services
 - 1.2 Service Level Agreement (SLA)
 - 1.3 IT Service Management
 - 1.4 Reference Models for IT Service Management
2. IT Infrastructure Library (ITIL)
 - 2.1 Purpose and content of the IT Infrastructure Library
 - 2.2 Service Live Cycle in ITIL
 - 2.3 Overview on Service Strategy and Operational Processes
 - 2.4 Continual Service Improvement
3. ITIL – Service Strategy

- 3.1 Business Relationship Management
- 3.2 Service Portfolio Management
- 3.3 Financial Management for Services
- 3.4 Demand Management
4. ITIL – Operational Processes: Service Design
 - 4.1 Service Level Management
 - 4.2 Service Catalogue Management
 - 4.3 Availability Management
 - 4.4 Service Continuity Management
5. ITIL – Operational Processes: Service Transition
 - 5.1 Transition Planning and Support
 - 5.2 Change Management
 - 5.3 Service Asset and Configuration Management
 - 5.4 Release and Deployment Management
6. ITIL – Operational Processes: Service Operation
 - 6.1 Incident Management
 - 6.2 Problem Management
 - 6.3 Request Fulfilment
 - 6.4 Event Management

Literature**Compulsory Reading****Further Reading**

- Love, V. D. & Ness, L. R. (2016). Integrating ITSM into the Corporate Environment. *Journal of Health Care Compliance*, 18(3), 5–12.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book	Exam Preparation <input checked="" type="checkbox"/> Online Tests

DevOps

Module Code: DLMDCCDO

Module Type see curriculum	Admission Requirements none	Study Level BA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Tianxiang Lu (DevOps)

Contributing Courses to Module

- DevOps (DLMDCCDO01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Case Study

Split Exam

Weight of Module

see curriculum

Module Contents

- Building and Testing
- Releases and Deployment
- Security and Maintenance
- Monitoring and Logging

Learning Outcomes**DevOps**

On successful completion, students will be able to

- define DevOps and related disciplines.
- plan the building and testing process for software.
- perform software releases and deployments.
- implement the security of applications.
- understand the need for monitoring and logging.

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 Master Programs in the IT & Technology field(s)

DevOps

Course Code: DLMDCCD001

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

Course Description

Software development and software maintenance used to be two different disciplines. Due to the growing complexity, interfaces, and interactions between the components, these have been combined in DevOps. DevOps engineers have a profound knowledge of software development and know how to operate the software. This course reflects the full spectrum of software DevOps starting from requirements, detailing build processes and collaboration, taking a deeper look into testing and deployment, focusing on software security until eventually finishing with monitoring and logging to ensure solid operations

Course Outcomes

On successful completion, students will be able to

- define DevOps and related disciplines.
- plan the building and testing process for software.
- perform software releases and deployments.
- implement the security of applications.
- understand the need for monitoring and logging.

Contents

1. Introduction to DevOps
 - 1.1 Term Definition
 - 1.2 Historical Development
 - 1.3 Software Getting More Complex
 - 1.4 Challenges in Deployment and Operations
 - 1.5 Security
2. Building Software
 - 2.1 Requirements
 - 2.2 Co-Development in Teams
 - 2.3 Configuration management with Git
 - 2.4 Solving Conflicts
 - 2.5 Continuous Builds

3. Testing Software
 - 3.1 Module Tests
 - 3.2 Integration Tests
 - 3.3 Measuring Coverage
 - 3.4 Test Automation
 - 3.5 Integrating Tests in Continuous Build
 - 3.6 User Acceptance Testing
4. Software Releases and Deployments
 - 4.1 Working With the Trunk
 - 4.2 Working With Branches
 - 4.3 Planning a Release
 - 4.4 Manual Deployment
 - 4.5 Automatic Deployment
5. Software Security
 - 5.1 Importance of Security
 - 5.2 Types of Security
 - 5.3 Security Testing
 - 5.4 Detecting Security Incidents
 - 5.5 Reacting to Security incidents
6. Monitoring and Logging
 - 6.1 Definition Monitoring
 - 6.2 Definition Logging
 - 6.3 Aggregating information
 - 6.4 Extracting KPIs
 - 6.5 Management Systems (Like Nagios)

Literature**Compulsory Reading****Further Reading**

- Farcic, V. (2016). The DevOps 2.0 Toolkit. Packt Publishing.
- Forsgren, N., Kim, G., & Humble, J. (2018). Accelerate: the Science behind DevOps: building and scaling high performing technology organizations (First edition). IT Revolution Press.
- Gift, N., Behrman, K., Deza, A., & Gheorghiu, G. (2019). Python for DevOps: learn ruthlessly effective automation (First edition). O'Reilly.
- Kim, G., Willis, J., Debois, P., Allspaw, J., & Humble, J. (2016). The DevOps handbook: how to create world-class agility, reliability, and security in technology organizations (First edition). IT Revolution Press.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Advanced Research Methods

Module Code: DLMARM

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Tamara Wehrstein (Advanced Research Methods)

Contributing Courses to Module

- Advanced Research Methods (DLMARM01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Written Assignment

Study Format: myStudies
Written Assessment: Written Assignment

Split Exam

Weight of Module

see curriculum

Module Contents

- Social Science and Research Paradigms
- Case Study Research
- Specific Topics of Qualitative Research
- Advanced Issues of Qualitative Research Conceptualization and Data Analysis
- Underlying Assumptions of Quantitative Research: Concepts and Consequences
- Evaluation Research

Learning Outcomes**Advanced Research Methods**

On successful completion, students will be able to

- understand and apply scientific methodologies in conducting empirical research.
- plan, design, and prepare research proposals.
- differentiate between different types of case studies, select and apply different data collection strategies.
- plan, conduct, and analyze case studies and surveys.
- scientifically analyze quantitative and qualitative data.
- conduct evaluation research to determine quality of research.

Links to other Modules within the Study Program

This module is similar to other modules in the field of Methods

Links to other Study Programs of the University

All Master Programmes in the Business & Management fields

Advanced Research Methods

Course Code: DLMARM01

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

Course Description

Advanced research methods, specifically business research, is scientific inquiry that attempts to uncover new information which helps a business improve performance, maximizing shareholder value while adhering to ethical and moral compliance standards. Managers seeking to conduct empirical research must maintain validity, reliability, and trustworthiness when utilizing scientific methodologies in order to produce meaningful and actionable results. Research proposals are typically written prior to conducting research, which have a certain structure, enabling the researcher to properly plan, conduct, and analyze case studies and surveys. Different data collection strategies are used to collect both qualitative and quantitative data, depending on the research proposal goals. Managers utilize their understanding of research methodologies to accurately assess the quality of research.

Course Outcomes

On successful completion, students will be able to

- understand and apply scientific methodologies in conducting empirical research.
- plan, design, and prepare research proposals.
- differentiate between different types of case studies, select and apply different data collection strategies.
- plan, conduct, and analyze case studies and surveys.
- scientifically analyze quantitative and qualitative data.
- conduct evaluation research to determine quality of research.

Contents

1. Theoretical Background: Social Science and Research Paradigms
 - 1.1 What is a Paradigm?
 - 1.2 Empiricism
 - 1.3 Critical Rationalism
 - 1.4 Epistemological Anarchism
 - 1.5 Structural Functionalism
 - 1.6 Symbolic Interactionism
 - 1.7 Ethnomethodology
2. Case Study Research

- 2.1 Types of Case Study Research
- 2.2 Maintaining Quality in Case Study Research
- 2.3 Case Study Design
- 2.4 Implementing Case Studies
- 2.5 Analyzing Case Studies
3. Specific Topics of Qualitative Research
 - 3.1 Idea Generation
 - 3.2 Critical Incident Technique
 - 3.3 Understanding Communication: Discourse Analysis
 - 3.4 Perceiving Perception: Interpretive Phenomenological Analysis
4. Advanced Issues of Qualitative Research Conceptualizing and Data Analysis
 - 4.1 Measurement Theory
 - 4.2 Index and Scale Construction
 - 4.3 Types of Scale Construction
 - 4.4 The Problem of Nonresponse and Missing Data
 - 4.5 Implications of IT for Research Strategies
5. Underlying Assumptions of Quantitative Research: Concepts and Consequences
 - 5.1 Classical Test Theory
 - 5.2 Probabilistic Test Theory
 - 5.3 Advanced Topics of Test Theory
6. Evaluation Research
 - 6.1 What is Evaluation Research?
 - 6.2 Types of Evaluation Research
 - 6.3 Meta-Analysis
 - 6.4 Meta-Evaluation

Literature**Compulsory Reading****Further Reading**

- Babbie, E. R. (2021). The practice of social research (15th ed.). Cengage Learning. - 14th ed. (2016)
- Crossman, A. (2019) How to conduct an index for research. (URL: <https://www.thoughtco.com/index-for-research-3026543> [last accessed on 15.03.2023]).
- Eurostat (n.d.) Beginners: Statistical concept - Index and base year (URL: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Beginners:Statistical_concept_-_Index_and_base_year [last accessed on 15.03.2023]).
- Giles, D. (2004). Advanced research methods in psychology (Reprint). Psychology Press.
- Rea, L.M. & Parker, R.A. (2014). Designing and conducting survey research: A comprehensive guide, (4th ed). Jossey-Bass.
- Saunders, M., Thornhill, A., & Lewis, P. (2019). Research methods for business students (8th ed). Pearson
- Takahashi, A. R. W., & Araujo, L. (2019). Case study research: Opening up research opportunities. RAUSP Management Journal, 55(1), 100–111.
- Widner, J., Woolcock, M., & Ortega Nieto, D. (Eds.). (2022). The case for case studies: Methods and applications in international development (strategies for social inquiry). Cambridge University Press.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Written Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Written Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Introduction to Cloud Computing and Serverless Computing

Module Code: DLMWIWCC1_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Andrew Adjah Sai (Introduction to Cloud Computing and Serverless Computing)

Contributing Courses to Module

- Introduction to Cloud Computing and Serverless Computing (DLMWIWCC01_E)

Module Exam Type

Module Exam

Study Format: Distance Learning
Exam, 90 Minutes

Split Exam

Weight of Module

see curriculum

Module Contents

- Cloud Computing Basics
- Service and Deployment Models for Cloud Computing
- Security and Privacy in the Cloud
- Cloud Computing Provider
- Typical Business Applications in the Cloud

Learning Outcomes**Introduction to Cloud Computing and Serverless Computing**

On successful completion, students will be able to

- know and understand definitions and categorizations of cloud computing,
- describe the underlying technologies that enable cloud computing,
- explain and evaluate service models of the cloud,
- understand and assess security risks of cloud solutions for enterprises,
- differentiate between cloud providers on the market and compare their services,
- evaluate business applications in the cloud.

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 Master Programs in the IT & Technology field

Introduction to Cloud Computing and Serverless Computing

Course Code: DLMWIWCC01_E

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

Course Description

Cloud computing stands for technical services, software products and infrastructures that can be called up at any time and are provided decentrally via the Internet. They cover the increasing requirements of the digital corporate world with scalable and flexible solutions. The aim of this course is therefore to teach basic concepts as well as service and deployment models of cloud computing. The course enables students to identify and evaluate suitable use cases in the business world for cloud solutions. The course first reviews basic cloud computing terminology and classifications. Then it describes necessary technology that have made cloud computing possible. Afterwards, opportunities and risks of using cloud solutions are reflected and evaluated. Based on this, typical cloud service models are discussed and essential security concepts for cloud solutions are presented. After an overview of central players in the cloud market, typical use cases in the business world are shown. Additionally to the technical aspects, this course also provides a basic understanding of the use and usability of cloud solutions in the business environment.

Course Outcomes

On successful completion, students will be able to

- know and understand definitions and categorizations of cloud computing,
- describe the underlying technologies that enable cloud computing,
- explain and evaluate service models of the cloud,
- understand and assess security risks of cloud solutions for enterprises,
- differentiate between cloud providers on the market and compare their services,
- evaluate business applications in the cloud.

Contents

1. Cloud Technologies Basics
 - 1.1 Definition and Categories of Cloud Computing
 - 1.2 History and Evolution of Cloud Computing and its Technology
 - 1.3 Distinguishing Cloud Computing from related Concepts (Grid Computing, ASP, etc.)
 - 1.4 Opportunities and Risks of using Cloud Computing

2. Technologies enabling Cloud Computing
 - 2.1 Internet/Web 2.0
 - 2.2 Data Center
 - 2.3 Virtualization
 - 2.4 Containerization
3. Service Models in the Cloud
 - 3.1 Infrastructure as a Service (IaaS)
 - 3.2 Platform as a Service (PaaS)
 - 3.3 Software as a Service (SaaS)
 - 3.4 Function as a Service (FaaS).
4. Operation Models for Cloud Computing
 - 4.1 Public Cloud
 - 4.2 Private Cloud
 - 4.3 Community Cloud
 - 4.4 Hybrid Cloud
5. Cloud Security and Privacy
 - 5.1 Typical Security Risks of Applications, Interfaces and Data
 - 5.2 Best Practices for Cloud Encryption and Security Architecture
 - 5.3 Aspects of Data Protection
6. Cloud Provider
 - 6.1 Overview of the Global Market of Cloud Providers
 - 6.2 Provider Example of the "Big-4" (AWS, IBM, Google and Microsoft)
7. Business Use Cases and Application Examples
 - 7.1 Business Drivers for Cloud Computing
 - 7.2 Typical Application Examples (Data Analytics, ERP Solutions, IOT, Blockchain, and others)

Literature**Compulsory Reading****Further Reading**

- Chang, V., Walters, R. J. & Wills, G. (2015). Delivery and adoption of cloud computing services in contemporary organizations. IGI Global.
- Freeman, E. & Harvey, N. (2020). 97 things every cloud engineer should know. O'Reilly Media.
- Longbottom, C. (2017). Evolution of cloud computing: How to plan for change. BCS The Chartered Institute for IT.
- Ramachandran, M. (2016). Software security requirements management as an emerging cloud computing service. *International Journal of Information Management*, 36(4),580–590.
- Vacca, J. R. (2017). Cloud computing security: Foundations and challenges. CRC Press.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Project: Cloud Computing

Module Code: DLMWIWCC2_E

Module Type see curriculum	Admission Requirements DLMWIWCC01_E	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Andrew Adjah Sai (Project: Cloud Computing)

Contributing Courses to Module

- Project: Cloud Computing (DLMWIWCC02_E)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Project Report

Split Exam

Weight of Module

see curriculum

Module Contents

Identification of a use case, ideation, design and development of a custom cloud application, that runs on a cloud provider such as Amazon AWS or Microsoft Azure.

Learning Outcomes**Project: Cloud Computing**

On successful completion, students will be able to

- plan, implement and document a cloud based development project,
- identify a suitable cloud service provider and assess their available services for deployment of a recipe-based cloud architecture,
- identify and evaluate typical problems in different project phases of cloud solution development by using appropriate methods,
- answer and evaluate business-relevant questions for evaluating a cloud solution.

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 Master Programs in the IT & Technology fields

Project: Cloud Computing

Course Code: DLMWIWCC02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMWIWCC01_E

Course Description

In a world of digital enterprises, cloud computing plays a crucial role in the design of modern, scalable and flexible enterprise solutions. The potential is huge: Moving the company's own infrastructure to the cloud, hosting complex platform and software solutions in the cloud or provide simple and cost-effective services using serverless architectures are some examples of applied Cloud Computing. The aim of this course is to identify a real life use case for cloud computing in the context of an organization and to develop an appropriate cloud-based application prototype. The focus lays on the design and implementation using existing cloud service providers. Furthermore business-critical issues, such as feasibility, scalability, security and costs, are also to be evaluated and documented.

Course Outcomes

On successful completion, students will be able to

- plan, implement and document a cloud based development project,
- identify a suitable cloud service provider and assess their available services for deployment of a recipe-based cloud architecture,
- identify and evaluate typical problems in different project phases of cloud solution development by using appropriate methods,
- answer and evaluate business-relevant questions for evaluating a cloud solution.

Contents

- In the Project: Cloud Computing, students will demonstrate the knowledge, skills and competencies to identify, design and develop a cloud-based application prototype for a virtual enterprise. Students will develop ideas and proposals for a solution based on a given problem or an independently identified problem. Based on the selection of a suitable provider, such as Amazon AWS, a specification and design of a proof-of-concept solution is developed and documented. The documentation also considers the evaluation of aspects such as security and scalability.

Literature**Compulsory Reading****Further Reading**

- o. V. (o. J.): AWS Documentation. (URL: <https://docs.aws.amazon.com/index.html> [last accessed: 22.05.2020])
- Wadia, Y. et al. (2019): Implementing AWS: Design, Build, and Manage your Infrastructure. Packt Publishing Ltd., Birmingham UK.
- Zalazar A.S./Ballejos L./Rodriguez S. (2017): Analyzing Requirements Engineering for Cloud Computing. In: Ramachandran M./Mahmood Z. (ed.): Requirements Engineering for Service and Cloud Computing. Springer, Cham.
- Zardari, S./Faniyi, F./Bahsoon R. (2013): Cloud-Based Goal Oriented Requirements Engineering. In: Mistrík, I. et. al. (ed.): Aligning Enterprise, System, and Software Architectures. IGI Global, Hershey PA.

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

2. Semester

Product Development

Module Code: DLMBPDDT1

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Dorian Mora (Product Development)

Contributing Courses to Module

- Product Development (DLMBPDDT01)

Module Exam Type

Module Exam

Study Format: myStudies
Exam, 90 Minutes

Study Format: Distance Learning
Exam, 90 Minutes

Split Exam

Weight of Module

see curriculum

Module Contents

- Production planning techniques
- Design tasks
- Product development approaches
- Digital product development and organizational aspects

Learning Outcomes**Product Development**

On successful completion, students will be able to

- know the basic definitions and principles of (new) product development.
- understand the key skills in product development.
- discuss, differentiate, and select appropriate product development approaches with respect to a given scenario.
- work with digital product development tools and techniques like CAD, PDM and PLM at a basic level.
- develop own solutions and approaches to academic and practical questions.
- discuss, evaluate, and adapt different digital product development techniques and tools.

Links to other Modules within the Study Program

This module is similar to other modules in the field of Design

Links to other Study Programs of the University

All Master Programs in the Design, Architecture & Construction field

Product Development

Course Code: DLMBPDDT01

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

Course Description

This course aims to provide basic work and problem-solving methods for the successful development of products. It introduces the definition of key design tasks and various alternative product development approaches such as flow-based, lean product development, and design thinking. Finally, the students will become familiar with the use of computer-aided design (CAD) tools and how they integrate into modern product development approaches.

Course Outcomes

On successful completion, students will be able to

- know the basic definitions and principles of (new) product development.
- understand the key skills in product development.
- discuss, differentiate, and select appropriate product development approaches with respect to a given scenario.
- work with digital product development tools and techniques like CAD, PDM and PLM at a basic level.
- develop own solutions and approaches to academic and practical questions.
- discuss, evaluate, and adapt different digital product development techniques and tools.

Contents

1. Introduction
 - 1.1 Basic Definitions
 - 1.2 The Product Development Process
 - 1.3 Indicators and Metrics
 - 1.4 Product Development Models
 - 1.5 Current Trends in Product Development
2. The Product Development Process
 - 2.1 Planning
 - 2.2 Concept Development
 - 2.3 Design
 - 2.4 Testing and Refinement
 - 2.5 Production and Ramp-up

3. Product Development Approaches
 - 3.1 Lean Product Development
 - 3.2 Design Thinking
 - 3.3 Human-Centered Design
 - 3.4 User Experience Strategy
 - 3.5 Open Innovation
4. Digital Tools
 - 4.1 Computer-Aided Design
 - 4.2 Computer-Aided Quality
 - 4.3 Product Data Management
 - 4.4 Product Lifecycle Management
5. Organizational Perspective
 - 5.1 Incremental, Platform, and Breakthrough Development
 - 5.2 Building Teams
 - 5.3 Political Issues in Organizations
 - 5.4 Distributed New Product Development

Literature

Compulsory Reading

Further Reading

- Kahn, K. B., Kay, S. E., Slotegraaf, R. J., & Uban, S. (Eds.). (2012). The PDMA handbook of new product development (3rd ed.). Hoboken, NJ: John Wiley & Sons. (Database: ProQuest).
- Ottosson, S. (2018). Developing and managing innovation in a fast changing and complex world: Benefiting from dynamic principles. Cham: Springer. (Database: ProQuest).
- Ulrich, K. T., & Eppinger, S. D. (2016). Product design and development (6th ed.). New York, NY: McGraw Hill.

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Design Thinking

Module Code: DLMBPDDT2

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimaldauer: 1 Semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Dorian Mora (Design Thinking)

Contributing Courses to Module

- Design Thinking (DLMBPDDT02)

Module Exam Type

Module Exam

Study Format: myStudies
Written Assessment: Project Report
Study Format: Distance Learning
Written Assessment: Project Report

Split Exam

Weight of Module

see curriculum

Module Contents

This course will put students in the mindset of Design Thinking. Students will be introduced to phases and distinct methods for inspiration, as well as the ideation and implementation of products. A current list of topics is located in the Learning Management System.

Learning Outcomes**Design Thinking**

On successful completion, students will be able to

- comprehend, critically reflect on, and adopt the Design Thinking mindset.
- understand the inspiration, ideation, and implementation phases.
- evaluate and identify appropriate methods from the toolbox of human-centered design for given design tasks and challenges.

Links to other Modules within the Study Program

This module is similar to other modules in the field of Design

Links to other Study Programs of the University

All Master Programs in the Design, Architecture & Construction field

Design Thinking

Course Code: DLMBPDDT02

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

Course Description

In this course, students will receive a hands-on introduction to human-centered design via the Design Thinking method. Beyond conveying the individual basic principles, the procedures in Design Thinking are examined in detail. In order to fully understand Design Thinking in terms of important aspects in practice, selected methods for the individual process steps are presented in theory and application. Students will learn to improve their design process by reflecting on and adapting their activities.

Course Outcomes

On successful completion, students will be able to

- comprehend, critically reflect on, and adopt the Design Thinking mindset.
- understand the inspiration, ideation, and implementation phases.
- evaluate and identify appropriate methods from the toolbox of human-centered design for given design tasks and challenges.

Contents

- The course covers current topics and trends in Design Thinking, illustrating some methods and techniques as well as case studies. Each participant must create a project report on a chosen project, where he/she describes the application of the Design Thinking approach to a real product development scenario.

Literature**Compulsory Reading****Further Reading**

- IDEO.org. (2015). The Field Guide to Human-Centered Design. A step-by-step guide that will get you solving problems like a designer. Retrieved from <http://www.designkit.org/resources/1>
- Pressman, Andy (2019): Design Thinking. A Guide to Creative Problem Solving for Everyone, New York : Routledge.
- Lockwood, T., & Papke, E. (n.d.). Innovation by design : how any organization can leverage design thinking to produce change, drive new ideas, and deliver meaningful solutions.
- Lewrick, M., Link, P., Leifer, L. J., & Langensand, N. (2018). The design thinking playbook : mindful digital transformation of teams, products, services, businesses and ecosystems. John Wiley & Sons.

Study Format myStudies

Study Format myStudies	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Cyber Security and Data Protection

Module Code: DLMCSITSDP

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

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

Contributing Courses to Module

- Cyber Security and Data Protection (DLMCSITSDP01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Oral Assignment
Study Format: myStudies
Oral Assignment

Split Exam

Weight of Module

see curriculum

Module Contents

- Data protection and privacy
- Cyber security building blocks
- Cyber security management
- Cryptography concepts
- Cryptography applications

Learning Outcomes**Cyber Security and Data Protection**

On successful completion, students will be able to

- explain the core concepts of cyber security, data protection, and cryptography including their differences and relationships.
- compare the approaches to data protection within in different legal systems.
- apply data protection concepts to data science and other application scenarios.
- analyze application scenarios to identify the adequate cyber security management measures that should be implemented.
- explain the different approaches to data protection in different cultures.

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 Master Programmes in the IT & Technology field

Cyber Security and Data Protection

Course Code: DLMCSITSDP01

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

Course Description

With the increasing digitization and networking of IT systems, the need for safeguarding systems and the data processed by these systems has grown. The aim of this module is to provide an understanding of security measures needed, cyber security including cryptography, and data protection. While the need for cyber security is similar around the world, different cultures have different expectations regarding data protection and privacy. Nevertheless, personal data are often processed outside the country where the affected individuals live. Hence, the cultural aspects of data protection need to be taken into account wherever the data are processed. This course provides an overview of the main cyber security measures in different application scenarios, as well as their integration into an Information Security Management System, with particular focus on the relevant ISO/IEC 270xx family of standards. Cryptography provides an important tool set for cyber security and is used in many different application scenarios such as secure Internet protocols and block chain.

Course Outcomes

On successful completion, students will be able to

- explain the core concepts of cyber security, data protection, and cryptography including their differences and relationships.
- compare the approaches to data protection within in different legal systems.
- apply data protection concepts to data science and other application scenarios.
- analyze application scenarios to identify the adequate cyber security management measures that should be implemented.
- explain the different approaches to data protection in different cultures.

Contents

1. Foundations of Data Protection and Cyber Security
 - 1.1 Terminology and Risk Management
 - 1.2 Core Concepts of Cyber Security
 - 1.3 Core Concepts of Data Protection and Privacy
 - 1.4 Core Concepts of Cryptography
 - 1.5 Legal Aspects
2. Data Protection

- 2.1 Basic Concepts of Data Protection (ISO/IEC 29100, Privacy by Design)
- 2.2 Data Protection in Europe: the GDPR
- 2.3 Data Protection in the USA
- 2.4 Data Protection in Asia
3. Applying Data Protection
 - 3.1 Anonymity and Pseudonyms (k-Anonymity, i-Diversity, Differential Privacy)
 - 3.2 Data Protection in Data Science and Big Data
 - 3.3 User Tracking in Online Marketing
 - 3.4 Cloud Computing
4. Building Blocks of Cyber Security
 - 4.1 Authentication, Access Management and Control
 - 4.2 Cyber Security in Networks
 - 4.3 Developing Secure IT Systems (OWASP, etc.)
5. Cyber Security Management
 - 5.1 Security Policy
 - 5.2 Security and Risk Analysis
 - 5.3 The ISO 270xx Series
 - 5.4 IT Security and IT Governance
 - 5.5 Example: Cyber Security for Credit Cards (PCI DSS)
6. Cryptography
 - 6.1 Symmetric Cryptography
 - 6.2 Asymmetric Cryptography
 - 6.3 Hash Functions
 - 6.4 Secure Data Exchange (Diffie-Hellman, Perfect Forward Secrecy, etc.)
7. Cryptographic Applications
 - 7.1 Digital Signatures
 - 7.2 Electronic Money
 - 7.3 Secure Internet Protocols (TLS, IPSec, etc.)
 - 7.4 Block Chain

Literature**Compulsory Reading****Further Reading**

- Amoroso, E., & Amoroso, M. (2017). From CIA to APT: An introduction to cyber security. Independently published.
- National Institute of Standards and Technology. (2018). Framework for improving critical infrastructure cybersecurity.
- Paar, C., & Pelzl, J. (2011). Understanding cryptography: A textbook for students and practitioners. Springer.
- Walker, B. (2019). Cyber security comprehensive beginners guide to learn the basics and effective methods of cyber security. Independently published.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Oral Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Oral Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Seminar: Applying Threat Intelligence

Module Code: DLMCSEECLS2_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimaldauer: 1 Semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Stephan Spitz (Seminar: Applying Threat Intelligence)

Contributing Courses to Module

- Seminar: Applying Threat Intelligence (DLMCSEECLS02_E)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Research Essay

Split Exam

Weight of Module

see curriculum

Module Contents

- Cyber resilience
- DevSecOps
- Threat Intelligence
- Crisis Management
- Security Culture

Learning Outcomes**Seminar: Applying Threat Intelligence**

On successful completion, students will be able to

- understand weaknesses in an organization's defenses.
- make recommendations on how to make the organization more resilient.
- utilize threat intelligence for secure application and systems design.

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 Master Programs in the IT & Technology fields

Seminar: Applying Threat Intelligence

Course Code: DLMCSEECLS02_E

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

Course Description

Cyber resilience is the practice of accepting that security will never be 100% watertight but the ability to limit damage and quickly detect and respond to incidents is of utmost importance. In this seminar, we examine reports from past incidents and identify threat intelligence, in particular the Techniques, Tactics and Procedures of criminals, that help in identifying effective defenses.

Course Outcomes

On successful completion, students will be able to

- understand weaknesses in an organization's defenses.
- make recommendations on how to make the organization more resilient.
- utilize threat intelligence for secure application and systems design.

Contents

- With a given report, the student will research the incident and independently find threat intelligence reports and data relevant to the given incident. A report will then summarize the security issues responsible for the incident and make recommendations as to how the victim could become more resilient to such attacks. Specific incident reports will be provided by the tutor but proposals by the students can be considered.

Literature

Compulsory Reading

Further Reading

- Adkins, H. et al (2020): Building Secure and Reliable Systems. First Edition, O'Reilly Media, Inc.
- Mitre ATT&CK®: <https://attack.mitre.org/>
- OASIS Cyber Threat Intelligence: https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=cti
- Ross, R. et al (2019): Developing Cyber Resilient Systems: A Systems Security Engineering Approach. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication 800-160 Volume 2. <https://doi.org/10.6028/NIST.SP.800-160v2>

Study Format Distance Learning

Study Format Distance Learning	Course Type Seminar
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Research Essay

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Container Orchestration

Module Code: DLMDCCCO

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	MA	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 (Container Orchestration)

Contributing Courses to Module

- Container Orchestration (DLMDCCCO01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Exam or Written Assessment: Case Study, 90 Minutes

Split Exam

Weight of Module

see curriculum

Module Contents

- Introduction to Containers
- Container Composition And Services
- Container Registries
- Container Orchestration
- Kubernetes
- Orchestration in Production

Learning Outcomes**Container Orchestration**

On successful completion, students will be able to

- transfer acquired theoretical knowledge to real-world case studies.
- apply the concepts covered in the preceding container orchestration course to build a running system.
- explain the design choices made in the selection of the deployed components and its implementation.
- translate the learned theories into the practice of orchestration.
- critically evaluate the resulting system's performance.

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 Master Programs in the IT & Technology field(s)

Container Orchestration

Course Code: DLMDCCC001

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

Course Description

Containers have become very popular in the last ten years. In many scenarios, they have completely replaced the software installation as it is much simpler, avoids dependencies and leads to much fewer issues for the software supplier. At the same time, service-oriented architectures have grown. Often, each container provides just one service of a whole service bouquet. As the services depend on each other, they must be orchestrated, which happens on container level. The standard for container orchestration is the open-source software Kubernetes, which was originally created by Google.

Course Outcomes

On successful completion, students will be able to

- transfer acquired theoretical knowledge to real-world case studies.
- apply the concepts covered in the preceding container orchestration course to build a running system.
- explain the design choices made in the selection of the deployed components and its implementation.
- translate the learned theories into the practice of orchestration.
- critically evaluate the resulting system's performance.

Contents

1. Introduction to Containers
 - 1.1 Software Installation Before Containers
 - 1.2 Need For a Standard Environment
 - 1.3 Containers vs. Virtual Machines
 - 1.4 Container Images
2. Container Composition and Services
 - 2.1 Service-Oriented Architectures
 - 2.2 Separation of Concerns
 - 2.3 Communication Between Containers
 - 2.4 Software-Defined Network
 - 2.5 Example with Docker-Compose

3. Container Registries
 - 3.1 Local Containers
 - 3.2 Updating Images
 - 3.3 Download and Running Images
 - 3.4 Public Registries
 - 3.5 Private Registries
4. Container Orchestration
 - 4.1 Cluster Building Blocks
 - 4.2 Overlay Networks
 - 4.3 Shared Storage
 - 4.4 Docker Swarm
5. Kubernetes
 - 5.1 Pods and How to Build Them
 - 5.2 Cgroups for Pod Processes
 - 5.3 Attaching a Network to the Pod
 - 5.4 Persistent Storage
 - 5.5 Running Pods and Kubelets
6. Orchestration In Production
 - 6.1 Pod Distribution
 - 6.2 Exposing Services
 - 6.3 Security
 - 6.4 Ensuring Stable Operations
 - 6.5 On-Demand Scalability
 - 6.6 Monitoring and Logging

Literature**Compulsory Reading****Further Reading**

- Dobies, J. & Wood, J. (2020). Kubernetes Operators: Automating the Container Orchestration Platform. O'Reilly.
- Saito, H., Lee, H-C. C. & Hsu, K-J. C. (2018). Kubernetes Cookbook: Practical Solutions to Container Orchestration (2nd ed.). Packt Publishing
- Sayfan, G. (2018) Mastering Kubernetes: Level up Your Container Orchestration Skills with Kubernetes to Build, Run, Secure, and Observe Large-Scale Distributed Apps (3rd ed.). Packt Publishing
- Schenker, G. N. (2020). Learn Docker - Fundamentals of Docker 19. x: Build, Test, Ship, and Run Containers with Docker and Kubernetes. (2nd ed.). Packt Publishing

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam or Written Assessment: Case Study, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Project: Container Orchestration

Module Code: DLMDCCPCO

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

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

Module Coordinator

Prof. Dr. Christian Winkler (Project: Container Orchestration)

Contributing Courses to Module

- Project: Container Orchestration (DLMDCCPCO01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Project Report

Split Exam

Weight of Module

see curriculum

Module Contents

Containers will be introduced with docker and used in more complex scenarios with docker-compose. Afterwards, container registries will be shown and lead to container orchestration. The most popular software for this orchestration is Kubernetes, which will be implemented to build a production setup.

Learning Outcomes**Project: Container Orchestration**

On successful completion, students will be able to

- transfer acquired theoretical knowledge to real-world case studies.
- apply the concepts covered in the preceding container orchestration course to build a running system.
- explain the design choices made in the selection of the deployed components and its implementation.
- translate the learned theories into the practice of orchestration.
- critically evaluate the resulting system's performance.

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 Master Programs in the IT & Technology field(s)

Project: Container Orchestration

Course Code: DLMDCCPC001

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

Course Description

Containers have become very popular and are used on many deployment scenarios. This course works by giving hand-on examples of how this technology can be used. Running simple containers is not difficult. Using a service-oriented approach, many more containers will be necessary which have to be orchestrated. There are several strategies available for coping with these dependencies. Several standard software will be used and evaluated.

Course Outcomes

On successful completion, students will be able to

- transfer acquired theoretical knowledge to real-world case studies.
- apply the concepts covered in the preceding container orchestration course to build a running system.
- explain the design choices made in the selection of the deployed components and its implementation.
- translate the learned theories into the practice of orchestration.
- critically evaluate the resulting system's performance.

Contents

- Containers will be introduced for the different operating systems (Linux, Windows, MacOS). A first container will be built and run; updates will be performed to the container image. More complex scenarios require container composition. This will be introduced using docker-compose and a software-defined network. Using containers on different computers is much easier with container registries – these can be public or private. Container orchestration has different aspects like overlay networks and storage mapping which will be explored with docker swarm and later with Kubernetes. Kubernetes works with pods and has extensive configuration options which will all be explored. Additionally, a deployment scenario to a production environment will be shown including service exposition, monitoring, and logging.

Literature**Compulsory Reading****Further Reading**

- Saito, H., Lee, H-C. C. & Hsu, K-J. C. (2018). Kubernetes Cookbook: Practical Solutions to Container Orchestration. (2nd ed.) Packt Publishing
- Sayfan, G. (2020) Mastering Kubernetes: Level up Your Container Orchestration Skills with Kubernetes to Build, Run, Secure, and Observe Large-Scale Distributed Apps. (3rd ed.). Packt Publishing
- Schenker, G. N. (2020). Learn Docker - Fundamentals of Docker 19. x: Build, Test, Ship, and Run Containers with Docker and Kubernetes. (2nd ed.). Packt Publishing
- Docker Documentation. (2022). <https://docs.docker.com/>.
- Kubernetes Documentation. (2022). <https://kubernetes.io/docs/home/>.

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

3. Semester

Cyber Risk Assessment and Management

Module Code: DLMCSECRAM_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Carsten Skerra (Cyber Risk Assessment and Management)

Contributing Courses to Module

- Cyber Risk Assessment and Management (DLMCSECRAM01_E)

Module Exam Type

Module Exam

Study Format: Distance Learning
Exam, 90 Minutes

Study Format: myStudies
Exam, 90 Minutes

Split Exam

Weight of Module

see curriculum

Module Contents

- Organizational IT Risk Management
- Measuring the Cyber Threat
- Threat Modeling
- Standardization and Compliance
- Risk Assessment
- The Cyber-Resilient Organization

Learning Outcomes**Cyber Risk Assessment and Management**

On successful completion, students will be able to

- understand the process of attack modeling.
- associate a cost with attack outcomes.
- understand black swan events.
- evaluate the impact that legislation has on risks and costs.
- understand how an organization needs to make decisions based on risk.

Links to other Modules within the Study Program

This module is similar to other modules in the fields of Computer Science & Software Development

Links to other Study Programs of the University

All Master Programs in the IT & Technology fields

Cyber Risk Assessment and Management

Course Code: DLMCSECRAM01_E

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

Course Description

Decisions on making changes or not should be informed by the risk of that action or inaction. This is dictated by the cost a potentially successful attack would have. But how to model attacks and associate costs with them? We will explore the discipline of attack modeling and risk evaluation in this course.

Course Outcomes

On successful completion, students will be able to

- understand the process of attack modeling.
- associate a cost with attack outcomes.
- understand black swan events.
- evaluate the impact that legislation has on risks and costs.
- understand how an organization needs to make decisions based on risk.

Contents

1. Organizational IT Risk Management
 - 1.1 Business Need of Risk Management
 - 1.2 Anatomy of a Data Exfiltration Attack
 - 1.3 Cyber Catastrophes
 - 1.4 Cyber Risk
2. Measuring the Cyber Threat
 - 2.1 Measurement and Management
 - 2.2 Cyber Threat Metrics
 - 2.3 Measuring the Threat for an Organization
 - 2.4 The Likelihood of Major Cyber Attacks
 - 2.5 Black Swan Events
3. Threat Modeling
 - 3.1 Attack Tree Methodology
 - 3.2 STRIDE
 - 3.3 DREAD

3.4	LINDDUN
4.	Standardization and Compliance
4.1	NIST Risk Management Framework
4.2	ISO 27005
4.3	BSI 100-3
5.	Risk Assessment
5.1	Methodologies
5.2	Factoring in Black Swan Events
5.3	Continuous Reevaluation
6.	The Cyber-Resilient Organization
6.1	Changing Approaches to Risk Management
6.2	Incident Response and Crisis Management
6.3	Resilience Engineering, Security Solutions and Finances
6.4	Cyber Insurance

Literature
Compulsory Reading
Further Reading
<ul style="list-style-type: none">▪ Antonucci, D. (2017). The cyber risk handbook: Creating and measuring effective cybersecurity capabilities. Wiley.▪ Refsdal, A., Solhaug, B., & Stolen, K. (2015). Cyber-risk management. Springer.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Seminar: Computer Science and Society

Module Code: DLMCSCSAS

Module Type see curriculum	Admission Requirements None	Study Level MA	CP 5	Student Workload 150 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Johannes Kent Walter (Seminar: Computer Science and Society)

Contributing Courses to Module

- Seminar: Computer Science and Society (DLMCSCSAS01)

Module Exam Type

Module Exam

Study Format: Distance Learning
Written Assessment: Research Essay
Study Format: myStudies
Written Assessment: Research Essay

Split Exam

Weight of Module

see curriculum

Module Contents

- The seminar covers the relationship between computer science and society, including topics such as the social responsibility of computer scientists and the effects of digitization on society. Based on a list of topics updated regularly, students select or are assigned a specific topic on which to write a scientific report.

Learning Outcomes**Seminar: Computer Science and Society**

On successful completion, students will be able to

- name the main questions regarding the relationship between computer science and society.
- discuss selected topics regarding the relationship between computer science and society.
- analyze one aspect of the relationship between computer science and society in detail.
- take selected topics and case studies and link them with well-known concepts, as well as critically question and discuss them.
- transfer theoretically acquired knowledge to a specific context.
- edit scientifically a select topic.

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 Master Programmes in the IT & Technology field.

Seminar: Computer Science and Society

Course Code: DLMCSSCSAS01

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

Course Description

The seminar covers the relationship between computer science and society. Over the past several decades, computer science has greatly changed society, and it is important that prospective computer scientists think about the effects of computer science on society and take these influences into account in their work. Typical topics to be addressed include, for example, the effects of ethics and professionalism in computing, the responsibility of computer scientists, the effects of data science and social networks on society, surveillance, and dual use of IT.

Course Outcomes

On successful completion, students will be able to

- name the main questions regarding the relationship between computer science and society.
- discuss selected topics regarding the relationship between computer science and society.
- analyze one aspect of the relationship between computer science and society in detail.
- take selected topics and case studies and link them with well-known concepts, as well as critically question and discuss them.
- transfer theoretically acquired knowledge to a specific context.
- edit scientifically a select topic.

Contents

- The seminar covers different topics regarding the relationship between computer science and society. Each participant must create a seminar paper on a topic assigned to him/her and present the contents of the written paper.

Literature

Compulsory Reading

Further Reading

- Turabian, K. L. (2013). A manual for writers of research papers, theses, and dissertations. Chicago: University of Chicago Press.
- Swales, J. M., & Feak, C. R. (2012). Academic writing for graduate students, essential tasks and skills. Michigan: University of Michigan Press.
- Bailey, S. (2011). Academic writing for international students of business. New York, NY: Routledge

Study Format Distance Learning

Study Format Distance Learning	Course Type Seminar
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Research Essay

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Study Format myStudies

Study Format myStudies	Course Type Seminar
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Research Essay

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

IT Governance, Compliance and Service Management

Module Code: DLMDCCEIGCSM

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	MA	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. André Köhler (IT Service Management) / Johannes Kent Walter (Corporate Governance of IT, Compliance, and Law)

Contributing Courses to Module

- IT Service Management (DLMBITGSM01)
- Corporate Governance of IT, Compliance, and Law (DLMIGCR01-01_E)

Module Exam Type

Module Exam

Split Exam

IT Service Management

- Study Format "Distance Learning": Exam, 90 Minutes
- Study Format "myStudies": Exam, 90 Minutes

Corporate Governance of IT, Compliance, and Law

- Study Format "Distance Learning": Exam, 90 Minutes
- Study Format "myStudies": Exam, 90 Minutes

Weight of Module

see curriculum

<p>Module Contents</p> <p>IT Service Management</p> <ul style="list-style-type: none"> ▪ IT infrastructure library (ITIL) ▪ ITIL service strategy ▪ ITIL service design ▪ ITIL service transition ▪ ITIL service operation <p>Corporate Governance of IT, Compliance, and Law</p> <ul style="list-style-type: none"> ▪ IT Governance: Motivation and Challenges ▪ COBIT Framework ▪ IT Compliance ▪ IT basic protection according to BSI IT law 	
<p>Learning Outcomes</p> <p>IT Service Management</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ understand IT service management as the enabler of information technology strategies and operations objectives. ▪ define the touchpoints between IT service management and management information systems. ▪ differentiate between lightweight and heavyweight approaches to IT service management. ▪ understand benchmarks and assessments to measure the capability of a service provider and its IT service management competences. ▪ apply IT services management tools and platforms proactively based on current information technology research and advisory. <p>Corporate Governance of IT, Compliance, and Law</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ explain the terms IT governance and IT compliance. ▪ categorize typical processes and activities from the area of IT governance and IT compliance. ▪ give an overview of the COBIT framework and its elements. ▪ give an overview of IT-Governance and explain its structure. ▪ reproduce important laws and regulations in the field of IT law and explain their areas of application. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Computer Science & Software Development</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the IT & Technology field</p>

IT Service Management

Course Code: DLMBITGSM01

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

Course Description

This course focuses on the nature and practice of IT services that keep IT systems running. It introduces students to the knowledge and experience needed to provide IT as a service to organizations, mainly based on the IT Infrastructure Library (ITIL) which is the industry standard for this purpose.

Course Outcomes

On successful completion, students will be able to

- understand IT service management as the enabler of information technology strategies and operations objectives.
- define the touchpoints between IT service management and management information systems.
- differentiate between lightweight and heavyweight approaches to IT service management.
- understand benchmarks and assessments to measure the capability of a service provider and its IT service management competences.
- apply IT services management tools and platforms proactively based on current information technology research and advisory.

Contents

1. Introduction to IT Service Management
 - 1.1 IT Services, Business IT Services
 - 1.2 Service Level Agreement (SLA)
 - 1.3 IT Service Management
 - 1.4 Reference Models for IT Service Management
2. IT Infrastructure Library (ITIL)
 - 2.1 Purpose and content of the IT Infrastructure Library
 - 2.2 Service Live Cycle in ITIL
 - 2.3 Overview on Service Strategy and Operational Processes
 - 2.4 Continual Service Improvement
3. ITIL – Service Strategy

- 3.1 Business Relationship Management
- 3.2 Service Portfolio Management
- 3.3 Financial Management for Services
- 3.4 Demand Management
4. ITIL – Operational Processes: Service Design
 - 4.1 Service Level Management
 - 4.2 Service Catalogue Management
 - 4.3 Availability Management
 - 4.4 Service Continuity Management
5. ITIL – Operational Processes: Service Transition
 - 5.1 Transition Planning and Support
 - 5.2 Change Management
 - 5.3 Service Asset and Configuration Management
 - 5.4 Release and Deployment Management
6. ITIL – Operational Processes: Service Operation
 - 6.1 Incident Management
 - 6.2 Problem Management
 - 6.3 Request Fulfilment
 - 6.4 Event Management

Literature**Compulsory Reading****Further Reading**

- Love, V. D. & Ness, L. R. (2016). Integrating ITSM into the Corporate Environment. *Journal of Health Care Compliance*, 18(3), 5–12.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book	Exam Preparation <input checked="" type="checkbox"/> Online Tests

Corporate Governance of IT, Compliance, and Law

Course Code: DLMIGCR01-01_E

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

Course Description

In this course, students learn terms and frameworks related to IT governance and IT compliance. First, a short introduction and an overview of the different aspects of IT governance and IT compliance are given; then, COBIT and IT basic protection are explained as two frameworks that are used in industrial practice. In addition, this course will introduce and discuss important legal frameworks and standards related to IT law.

Course Outcomes

On successful completion, students will be able to

- explain the terms IT governance and IT compliance.
- categorize typical processes and activities from the area of IT governance and IT compliance.
- give an overview of the COBIT framework and its elements.
- give an overview of IT-Governance and explain its structure.
- reproduce important laws and regulations in the field of IT law and explain their areas of application.

Contents

1. IT Governance: Motivation and Challenges
 - 1.1 Governance and IT Governance
 - 1.2 Frameworks for IT Governance
 - 1.3 Typical IT Governance, Service Management, and Security Frameworks and Standards
2. COBIT Framework
 - 2.1 Overview of the Elements of COBIT
 - 2.2 Governance and Management Objectives
 - 2.3 Use of COBIT and COBIT Design Factors
 - 2.4 The Target Cascade of COBIT
3. IT Compliance
 - 3.1 Introduction to IT Compliance
 - 3.2 Examples of National and International Guidelines: Risk Management Standards and Frameworks

- 3.3 IT Compliance: Typical Measures
4. Basic IT Protection According to BSI
 - 4.1 Overview and Structure
 - 4.2 Approach to IT Security Governance
 - 4.3 Usage Example of IT Security Governance
5. Introduction to IT Service Management
 - 5.1 What is Information Technology Service Management?
 - 5.2 What is ITIL® V4?
 - 5.3 What is ISO/IEC 20000-1:2018?
 - 5.4 Other ITSM Frameworks and Standards
6. IT Law
 - 6.1 Overview of Relevant Laws
 - 6.2 Protection of Intellectual Property
 - 6.3 IT Contracts
 - 6.4 Privacy

Literature**Compulsory Reading****Further Reading**

- Cervone, H. F. (2017). Implementing IT governance: A primer for informaticians. *Digital Library Perspectives*, 33(4), 282–287.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Secure Software Development

Module Code: DLMCSEEDSO_E

Module Type see curriculum	Admission Requirements <ul style="list-style-type: none"> ▪ none ▪ DLMCSEEDSO01_E or DLMCSEEDSO01_D 	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Petra Beenken (Secure Software Development) / Prof. Dr. Jesus Luna Garcia (Project: Secure Software Implementation)

Contributing Courses to Module

- Secure Software Development (DLMCSEEDSO01_E)
- Project: Secure Software Implementation (DLMCSEEDSO02_E)

Module Exam Type

Module Exam

Split Exam

Secure Software Development

- Study Format "Distance Learning": Exam, 90 Minutes

Project: Secure Software Implementation

- Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

<p>Module Contents</p> <p>Secure Software Development</p> <ul style="list-style-type: none"> ▪ Security by design ▪ Privacy by Design ▪ Testing and Auditing ▪ Software Supply Chain Security ▪ Common Coding Anti-Practices ▪ Project Management ▪ DevSecOps <p>Project: Secure Software Implementation</p> <ul style="list-style-type: none"> ▪ Secure software design and implementation ▪ Testing and auditing for security ▪ Patch and vulnerability management ▪ Software lifecycle 	
<p>Learning Outcomes</p> <p>Secure Software Development</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ design secure applications. ▪ understand what leads to software compromise. ▪ avoid common coding errors. ▪ manage the secure software lifecycle. ▪ employ a rigorous security testing regime. ▪ manage vulnerability disclosures. <p>Project: Secure Software Implementation</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ design the security for a simple software project. ▪ avoid common coding and design mistakes. ▪ define what steps are needed to implement secure code. ▪ create a process to maintain the continuous security of the application over its lifetime. ▪ effectively use vulnerability disclosures. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the fields of Computer Science & Software Development</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the IT & Technology fields</p>

Secure Software Development

Course Code: DLMCSEEDSO01_E

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

Course Description

Attacking vulnerabilities in insecure software is a leading attack vector for criminals and malicious state actors. Finding unknown, so-called zero-day vulnerabilities is a key weapon for professional criminals. So, it is of utmost importance to design and implement secure software. First we must understand common software weaknesses and then avoid these as early in the software development and lifecycle as possible through a security-by-design philosophy. We also must run and manage a security testing and vulnerability disclosure process. Providing and implementing timely patches is essential.

Course Outcomes

On successful completion, students will be able to

- design secure applications.
- understand what leads to software compromise.
- avoid common coding errors.
- manage the secure software lifecycle.
- employ a rigorous security testing regime.
- manage vulnerability disclosures.

Contents

1. Security by design
 - 1.1 IT-Support and testing by “Shifting Left” Methodology
 - 1.2 Infrastructure as Code
 - 1.3 Advantages of Considering Security Early
2. Privacy by Design
 - 2.1 Encryption
 - 2.2 Differential Privacy
 - 2.3 Zero-Knowledge Proofs/Protocols
3. Testing and Auditing
 - 3.1 Unit Testing
 - 3.2 Security Testing

- 3.3 Security Code Auditing
- 4. Software Supply Chain Security
 - 4.1 Package Security
 - 4.2 Container Security
 - 4.3 Programming Language Considerations
- 5. Common Coding Anti-Practices
 - 5.1 Classes of Bugs
 - 5.2 Sources Of Bugs
 - 5.3 Severity Of Bugs
- 6. Project Management
 - 6.1 The Software Lifecycle
 - 6.2 Managing Vulnerability Disclosures
 - 6.3 Managing Patches/Updating
 - 6.4 Managing Pentesting and Bug Bounty Programs
- 7. DevSecOps
 - 7.1 DevOps
 - 7.2 Cloud Security
 - 7.3 Continuous Integration, Testing, and Deployment
 - 7.4 Ephemeral Processes
 - 7.5 Automation

Literature

Compulsory Reading

Further Reading

- Adkins, H. et al (2020): Building Secure and Reliable Systems. 1st edition, O'Reilly Media, Newton, MA.
- Common Weakness Enumeration, <https://cwe.mitre.org/>
- Dwork, C. / Roth, A. (2014): The Algorithmic Foundations of Differential Privacy. In Foundations and Trends in Theoretical Computer Science Vol. 9, Nos. 3–4 (2014) 211–407.
- The Open Web Application Security Project, <https://owasp.org/>

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Project: Secure Software Implementation

Course Code: DLMCSEEDSO02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMCSEEDSO01_E or DLMCSEEDSO01_D

Course Description

Software is eating the world, so no organization can afford to deploy insecure code without eventually suffering dire consequences. In this project the student will tackle a secure application implementation and write a report justifying decisions made to ensure the security of the running system.

Course Outcomes

On successful completion, students will be able to

- design the security for a simple software project.
- avoid common coding and design mistakes.
- define what steps are needed to implement secure code.
- create a process to maintain the continuous security of the application over its lifetime.
- effectively use vulnerability disclosures.

Contents

- To a given problem and/or a given context, the student will design and develop a simple software project and then submit a report, code and data describing the security design decisions as well as plans for the future software lifecycle. Specific projects will be provided by the tutor but proposals by the students can be considered.

Literature

Compulsory Reading

Further Reading

- Adkins, H. et al (2020): Building Secure and Reliable Systems. 1st edition, O'Reilly Media, Newton, MA.
- Common Weakness Enumeration, <https://cwe.mitre.org/>
- Dwork, C. / Roth, A. (2014): The Algorithmic Foundations of Differential Privacy. In Foundations and Trends in Theoretical Computer Science Vol. 9, Nos. 3–4 (2014) 211–407.
- The Open Web Application Security Project, <https://owasp.org/>

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Audit- and Security Testing

Module Code: DLMCSEEST_E

Module Type see curriculum	Admission Requirements <ul style="list-style-type: none"> ▪ none ▪ DLMCSEEST01_E 	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Dr. Christian Prause (Attack Models and Auditing) / Dr. Radiah Rivu (Seminar: IT Security Tests)

Contributing Courses to Module

- Attack Models and Auditing (DLMCSEEST01_E)
- Seminar: IT Security Tests (DLMCSEEST02_E)

Module Exam Type

Module Exam

Split Exam

Attack Models and Auditing

- Study Format "Distance Learning": Exam, 90 Minutes

Seminar: IT Security Tests

- Study Format "Distance Learning": Written Assessment: Research Essay

Weight of Module

see curriculum

<p>Module Contents</p> <p>Attack Models and Auditing</p> <ul style="list-style-type: none"> ▪ Threat modelling ▪ Software testing and verification ▪ Pentesting tools ▪ Self-assessment and third-party audits ▪ Ethical hacking <p>Seminar: IT Security Tests</p> <p>Software and system auditing; Pentesting; Red/Blue teams; Bug Bounty programs</p>	
<p>Learning Outcomes</p> <p>Attack Models and Auditing</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ plan what to test and audit for. ▪ understand common pentesting tools. ▪ understand software testing and verification. ▪ organize self-assessments of the implemented ISMS. ▪ familiarize with widely used cybersecurity audit frameworks. ▪ run remote system audits. <p>Seminar: IT Security Tests</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ understand how bug bounty programs work. ▪ understand how to run a red/blue team or pentesting exercise. ▪ write a report showing aptitude in the subject. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the fields of Computer Science & Software Development</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the IT & Technology fields</p>

Attack Models and Auditing

Course Code: DLMCSEEST01_E

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

Course Description

The cybersecurity lifecycle comprehends a range of activities, where “checking” the implemented security concept provides a feedback loop to continuously improve the designed security levels. In practice, cybersecurity checks include an initial threat modeling step before the right tools and techniques can be used to test the security of the software or system. This can be a type of ethical hacking (e.g., pentesting, red/blue team exercise or bug bounty program), or a self-assessment or this-party audit of the deployed information security management system (ISMS).

Course Outcomes

On successful completion, students will be able to

- plan what to test and audit for.
- understand common pentesting tools.
- understand software testing and verification.
- organize self-assessments of the implemented ISMS.
- familiarize with widely used cybersecurity audit frameworks.
- run remote system audits.

Contents

1. Threat Modelling
 - 1.1 System Security Life Cycle
 - 1.2 Modelling applications and profiling threats
 - 1.3 Security testing based on a threat model
 - 1.4 OWASP Threat Dragon and Microsoft Threat Modelling Tool
2. Ethical Hacking
 - 2.1 Legal and compliance framework
 - 2.2 Pentesting process
 - 2.3 Red/Blue teams
 - 2.4 Bug bounty programs
3. Multi-layer system security testing
 - 3.1 Operating system exploits

- 3.2 Network penetration testing and tools
- 3.3 Web app penetration testing with OWASP and OSINT
- 3.4 Exploit development
4. Software testing
 - 4.1 Whitebox, blackbox and graybox testing
 - 4.2 Unit testing for security
 - 4.3 Fuzzing
 - 4.4 ISO/IEC 29119
5. Software verification
 - 5.1 Static code analysis
 - 5.2 Dynamic code analysis
 - 5.3 Peer review
 - 5.4 Formal verification
6. Cybersecurity Audits
 - 6.1 Self-assessments and third-party audits
 - 6.2 Risk-based approach to cybersecurity checks
 - 6.3 Auditing cybersecurity based on ISO/IEC 27001
 - 6.4 Toolset for automated audits

Literature

Compulsory Reading

Further Reading

- Graham, D. (2021). Ethical hacking: A hands-on introduction to breaking in. No Starch Press Incorporated.
- Keith Yorkston. (2021). Performance Testing: An ISTQB Certified Tester Foundation Level Specialist Certification Review: Vol. 1st ed . apress.
- Páez, F., & Kaschel, H. (2022). Design and Testing of a Computer Security Layer for the LIN Bus t. Sensors (14248220), 22(18), 6901–N.PAG.
- Li, H. (2022). Computer Security Issues and Legal System Based on Cloud Computing. Computational Intelligence & Neuroscience, 1–11.
- Shostack, A. (2014). Threat Modeling. Designing for Security. John Wiley & Sons, Hoboken, NJ. h
- Stallings, W., & Brown, L. (2018). Computer Security [electronic resource]: Principles and Practice (4th ed., global edition). Pearson Education, Limited.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Seminar: IT Security Tests

Course Code: DLMCSEEST02_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMCSEEST01_E

Course Description

A good security architecture is a fine thing, but it is always better to test it than to find out too late that there was one more hole to patch. In this seminar, the student will complete a report on a security audit method. This can be a type of pentesting, red/blue team exercise or bug bounty program. Alternatively, the report can cover a vulnerability report created from a public bug bounty program. The intension is that the student has the opportunity to go in depth with an aspect of this subject.

Course Outcomes

On successful completion, students will be able to

- understand how bug bounty programs work.
- understand how to run a red/blue team or pentesting exercise.
- write a report showing aptitude in the subject.

Contents

- Testing security is just as important as implementing it. This seminar will address this topic with reports on a variety of subjects the student can choose from. The student will use current literature to research the topic and write a report on it. Possible topics can be based on tools in the areas of WWW pentesting, fuzzing, code security auditing. Or topics can be chosen from playbooks from red and blue teams. Or the student may choose to look into best practices for setting up and managing bug bounty programs.

Literature**Compulsory Reading****Further Reading**

- Kim, P. (2014): The Hacker Playbook: Practical Guide To Penetration Testing. CreateSpace Independent Publishing Platform, Scotts Valley, CA.
- Kim, P. (2015): The Hacker Playbook 2: Practical Guide To Penetration Testing. CreateSpace Independent Publishing Platform, Scotts Valley, CA.
- Kim, P. (2018): The Hacker Playbook 3: Practical Guide To Penetration Testing. CreateSpace Independent Publishing Platform, Scotts Valley, CA.
- Klein, T. (2011): A Bug Hunter's Diary: A Guided Tour Through the Wilds of Software Security. No Starch Press, San Francisco, CA.
- McClure, S. / Scambray, J. / Kurtz, G. (2012): Hacking Exposed 7, McGraw-Hill, New York City, NY.
- The Zero-day Initiative blog: <https://www.zerodayinitiative.com/blog>

Study Format Distance Learning

Study Format Distance Learning	Course Type Seminar
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Research Essay

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Prerequisites for Machine Learning

Module Code: DLMDCCEPML

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

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

Module Coordinator

Prof. Dr. Robert Graf (Advanced Mathematics) / Dr. Cosmina Croitoru (Programming with Python)

Contributing Courses to Module

- Advanced Mathematics (DLMDSAM01)
- Programming with Python (DLMDSPWP01)

Module Exam Type

Module Exam

Split Exam

Advanced Mathematics

- Study Format "myStudies": Exam, 90 Minutes
- Study Format "Distance Learning": Exam, 90 Minutes (100)

Programming with Python

- Study Format "myStudies": Written Assessment: Written Assignment
- Study Format "Distance Learning": Written Assessment: Written Assignment

Weight of Module

see curriculum

<p>Module Contents</p> <p>Advanced Mathematics</p> <ul style="list-style-type: none"> ▪ Calculu ▪ Integral transformations ▪ Vector algebra ▪ Vector calculus ▪ Matrices and vector space ▪ Information theory <p>Programming with Python</p> <ul style="list-style-type: none"> ▪ Introduction to the Python programming language ▪ Object-oriented concepts in Python ▪ Handling of exceptions and errors ▪ The Python library ecosystem ▪ Environments and package management ▪ Documentation and testing ▪ Version control 	
<p>Learning Outcomes</p> <p>Advanced Mathematics</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ remember the fundamental rules of differentiation and integration. ▪ apply integration and differentiation techniques to vectors and vector fields. ▪ analyze matrix equations. ▪ understand the generalization of vectors to tensors. ▪ evaluate different metrics from information theoretical perspectives. <p>Programming with Python</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ remember basic Python syntax and programming concepts. ▪ understand object-oriented concepts in Python. ▪ analyze and apply different methods for error handling in Python. ▪ know common and important Python libraries and how to apply them to given programming tasks. ▪ understand concepts like environments and version control. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Methods and Data Science & Artificial Intelligence</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the IT & Technology fields</p>

Advanced Mathematics

Course Code: DLMDSAM01

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

Course Description

Modern techniques to analyze data and derive predictions for future events are deeply rooted in mathematical techniques. The course builds a solid base to understand the concepts behind advanced algorithms used to process, analyze, and predict data and observations and enables students to follow future research, especially in the fields of data-intensive sciences. The course reviews differentiation and integration and then discusses partial differentiation, differentiation, vector algebra and vector calculus. Matrix calculation and vector spaces are fundamental to many modern data processing algorithms and are discussed in detail. Calculations based on Tensors are introduced. Common metrics are discussed from an informational, theoretical point of view.

Course Outcomes

On successful completion, students will be able to

- remember the fundamental rules of differentiation and integration.
- apply integration and differentiation techniques to vectors and vector fields.
- analyze matrix equations.
- understand the generalization of vectors to tensors.
- evaluate different metrics from information theoretical perspectives.

Contents

1. Calculus
 - 1.1 Differentiation & Integration
 - 1.2 Partial Differentiation & Integration
 - 1.3 Vector Analysis
 - 1.4 Calculus of Variations
2. Integral Transformations
 - 2.1 Convolution
 - 2.2 Fourier Transformation
3. Vector Algebra
 - 3.1 Scalars and Vectors
 - 3.2 Addition, Subtraction of Vectors

3.3	Multiplication of Vectors, Vector Product, Scalar Product
4.	Vector Calculus
4.1	Integration of Vectors
4.2	Differentiation of Vectors
4.3	Scalar and Vector Fields
4.4	Vector Operators
5.	Matrices and Vector Spaces
5.1	Basic Matrix Algebra
5.2	Determinant, Trace, Transpose, Complex, and Hermitian Conjugates
5.3	Eigenvectors and Eigenvalues
5.4	Diagonalization
5.5	Tensors
6.	Information Theory
6.1	MSE
6.2	Gini Index
6.3	Entropy, Shannon Entropy, Kulback Leibler Distance
6.4	Cross Entropy

Literature
Compulsory Reading
Further Reading
<ul style="list-style-type: none">▪ Mathai, A. M., & Haubold, H. J. (2017). Linear algebra, a course for physicists and engineers (1st ed.) De Gruyter.▪ Riley, K. F., Hobson, M. P, & Bence, S. J. (2006). Mathematical methods for physics and engineering (2nd ed.). Cambridge University Press. – available, but it's from 2002▪ Yang, X.-S. (2018). Mathematics for Civil Engineers : An Introduction. Dunedin Academic Press.

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Review Book <input checked="" type="checkbox"/> Online Tests

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Review Book <input checked="" type="checkbox"/> Online Tests

Programming with Python

Course Code: DLMDSPWP01

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

Course Description

Python is one of the most versatile and widely used scripting languages. Its clean and uncluttered syntax as well as its straightforward design greatly contribute to this success and make it an ideal language for programming education. Its application ranges from web development to scientific computing. Especially in the fields of data science and artificial intelligence, it is the most common programming language supported by all major data-handling and analytical frameworks. This course provides a thorough introduction to the language and its main features, as well as insights into the rationale and application of important adjacent concepts such as environments, testing, and version control.

Course Outcomes

On successful completion, students will be able to

- remember basic Python syntax and programming concepts.
- understand object-oriented concepts in Python.
- analyze and apply different methods for error handling in Python.
- know common and important Python libraries and how to apply them to given programming tasks.
- understand concepts like environments and version control.

Contents

1. Introduction to Python
 - 1.1 Data structures
 - 1.2 Functions
 - 1.3 Flow control
 - 1.4 Input / Output
 - 1.5 Modules & packages
2. Classes and inheritance
 - 2.1 Scopes and namespaces
 - 2.2 Classes and inheritance
 - 2.3 Iterators and generators
3. Errors and exceptions

- 3.1 Syntax errors
- 3.2 Handling and raising exceptions
- 3.3 User-defined exceptions
4. Important libraries
 - 4.1 Standard Python library
 - 4.2 Scientific calculations
 - 4.3 Speeding up Python
 - 4.4 Visualization
 - 4.5 Accessing databases
5. Working with Python
 - 5.1 Virtual environments
 - 5.2 Managing packages
 - 5.3 Unit and integration testing
 - 5.4 Documenting code
6. Version control
 - 6.1 Introduction to version control
 - 6.2 Version control with GIT

Literature**Compulsory Reading****Further Reading**

- Lutz, M. (2017). Learning python (5th ed.). O'Reilly.
- Mathes, E. (2019). Python crash course. (2nd ed.). No Starch Press.

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Written Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Written Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Sustainable Corporate Development

Module Code: DLMCOWNUE_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

N.N. (Sustainable Business Models) / N.N. (Project: Developing a Sustainable Business Model)

Contributing Courses to Module

- Sustainable Business Models (DLMNMZGM01_E)
- Project: Developing a Sustainable Business Model (DLMNMPEGM01_E)

Module Exam Type

Module Exam

Split Exam

Sustainable Business Models

- Study Format "Distance Learning": Written Assessment: Written Assignment

Project: Developing a Sustainable Business Model

- Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

<p>Module Contents</p> <p>Sustainable Business Models</p> <ul style="list-style-type: none"> ▪ Fundamentals of Sustainable Business Models ▪ Current Developments in Sustainable Business Models ▪ Impact-Oriented Corporate Management ▪ Key Figures and Measurement ▪ Sustainable Business Models in Practice ▪ Practical Examples <p>Project: Developing a Sustainable Business Model</p> <p>In the course Project: Developing a Sustainable Business Model, students' knowledge is applied in practice. In this way, they will develop a sustainable business model themselves and can thus incorporate their own interests and specializations into the course.</p>	
<p>Learning Outcomes</p> <p>Sustainable Business Models</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ apply the fundamentals of sustainable business models in practice. ▪ critically evaluate business models in terms of their sustainability. ▪ identify potentials of sustainable business models. ▪ design impact-oriented and sustainable business models. <p>Project: Developing a Sustainable Business Model</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ integrate sustainable management into an existing business model. ▪ develop and build a new business model using sustainable management. ▪ integrate their own specific expertise and interests into a sustainable business model. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Business Administration & Management</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the Business & Administration field(s)</p>

Sustainable Business Models

Course Code: DLMNMZGM01_E

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

Course Description

The course Sustainable Business Models prepares students for the analysis and development of sustainable business models. The focus is on newly founded companies that integrate sustainability into their corporate strategy from the very beginning, but also on the sustainable transformation of already existing business models. Students will be given adequate models, methods, and tools to apply the knowledge of sustainable business models in practice and to identify challenges and potentials of these companies.

Course Outcomes

On successful completion, students will be able to

- apply the fundamentals of sustainable business models in practice.
- critically evaluate business models in terms of their sustainability.
- identify potentials of sustainable business models.
- design impact-oriented and sustainable business models.

Contents

1. Fundamentals of Sustainable Corporate Management
 - 1.1 Conceptual Principles
 - 1.2 Business and Social Potentials of Sustainable Corporate Development
 - 1.3 Different Types of Sustainable Business Models
2. Current Developments in Sustainable Business Models
 - 2.1 Approaches
 - 2.2 Legal Forms
 - 2.3 Framework Conditions
 - 2.4 Role of the Stakeholders
3. Impact-Oriented Business Models
 - 3.1 Introduction Impact Orientation
 - 3.2 Overview of Conceptual Fundamentals
 - 3.3 Methods of Impact-Oriented Business Models

4. Key Figures and Measurement
 - 4.1 Overview of the Most Important Approaches
 - 4.2 Effect and Impact Measurement
5. Sustainable Business Models in Practice
 - 5.1 Importance of Sustainable Business Models in the Context of "Sustainable Development"
 - 5.2 Importance of Sustainable Business Models for SMEs
 - 5.3 Integration of Business Models into Existing Corporate Structures
6. Practical Examples
 - 6.1 Case Studies
 - 6.2 Best Practice Examples

Literature

Compulsory Reading

Further Reading

- Boons, F. / Lüdeke-Freund, F. (2013): Business Models for Sustainable Innovation: State-of-the-Art and Steps Towards a Research Agenda. *Journal of Cleaner Production*, vol 45, pp. 9-19.
- Lüdeke-Freund, F. (2020): Sustainable Entrepreneurship, Innovation, and Business Models: Integrative Framework and Propositions for Future Research, *Business Strategy & the Environment*. Feb2020, Vol. 29 Issue 2, p. 665-681.
- Lüdeke-Freund, F. / Rauter, R. / Pedersen, E. / Nielsen, C. (2020): Sustainable Value Creation Through Business Models: The What, the Who and the How. *Journal of Business Models*. 2020, Vol. 8 Issue 3, p. 62-90.
- Lüdeke-Freund, F. / Breuer, H. / Massa, L. (2022): Sustainable Business Model Design – 45 Patterns. April 2022.
- Weidinger, C./Fischler, F./Schmidpeter, R. (2013): Sustainable Entrepreneurship: Business Success Through Sustainability, Springer, Berlin / Heidelberg. Freudenreich, B. / Lüdeke-Freund, F. / Schaltegger, S. (2020): A Stakeholder Theory Perspective on Business Models: Value Creation for Sustainability. *Journal of Business Ethics*. Sep2020, Vol. 166 Issue 1, p. 3-18.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Written Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Project: Developing a Sustainable Business Model

Course Code: DLMNMPEGM01_E

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

Course Description

Sustainable business models will form the new basis of tomorrow's economy due to significant changes in stakeholders and society at large. Therefore, these chances and opportunities should already be used in this course. In the course Development of a Sustainable Business Model the already acquired knowledge will be applied in practice. In this way, the students are to develop a sustainable business model themselves and can thus bring their own interests and specializations into the course. In this way, the theoretical knowledge is applied in practice.

Course Outcomes

On successful completion, students will be able to

- integrate sustainable management into an existing business model.
- develop and build a new business model using sustainable management.
- integrate their own specific expertise and interests into a sustainable business model.

Contents

- Companies are undergoing transformation. This is shown by the increasing demands of stakeholder groups (investors, society, employees, customers, politics, etc.) regarding sustainability. Reflecting upon this, existing as well as not yet founded companies have to follow this change and adapt their business models accordingly. This is the starting point of this course. To take advantage of the enormous entrepreneurial opportunities (investor attractiveness, employer branding, customer loyalty, increased sales, employee identification, etc.), students must be able to internalize these ways of thinking of a sustainable business model. In this way, a later competitive advantage in the labor market is developed. The challenge of the course is to think of sustainability in an integrative way and not to only as an add-on to a business model. The aim is to integrate sustainability into the core business and thus anchor sustainable management in the DNA of the company. The aim is to create business models that not only reduce negative impact, but also generate a positive social impact.

Literature**Compulsory Reading****Further Reading**

- Alba, C., & Dentchev, N. A. (2021). We Need Transdisciplinary Research on Sustainable Business Models. *Journal of Business Models*, 9(2), 72–86.
- Boons, F., & Laasch, O. (2019). Business Models for Sustainable Development: A Process Perspective. *Journal of Business Models*, 7(1), 9–12.
- Bozyazi, E. (2020). Social Sustainability and Digital Transformation. In E. S. B. Meyandoglu. *Digital Transformation in Business (theory/practice)*. Internationaler Verlag der Wissenschaft
- Endregat, N., & Pennink, B. (2021). Exploring the Coevolution of Traditional and Sustainable Business Models: A Paradox Perspective. *Journal of Business Models*, 9(2), 1–21
- Guldman, E., Bocken, N. M. P., & Brezet, H. (2019). A Design Thinking Framework for Circular Business Model Innovation. *Journal of Business Models*, 7(1), 39–70.
- Lüdeke-Freund, F., Rauter, R., Pedersen, E. R. G., & Nielsen, C. (2020). Sustainable Value Creation Through Business Models: The What, the Who and the How. *Journal of Business Models*, 8(3), 62–90.
- Lüdeke-Freund, F., Gold, S., & Bocken, N. M. P. (2019). A Review and Typology of Circular Economy Business Model Patterns. *Journal of Industrial Ecology*, 23(1), 36–61.

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Project Report

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Aspects of Modern Business Communication

Module Code: DLMCOWAMBK_E

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	MA	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. Caroline Trautwein (Conversation Management and Communication Techniques) / Caterina Fox (Business Communication and Storytelling)

Contributing Courses to Module

- Conversation Management and Communication Techniques (DLMWPGUK01_E)
- Business Communication and Storytelling (DLMCOBCST01_E)

Module Exam Type

Module Exam	Split Exam
	<p><u>Conversation Management and Communication Techniques</u></p> <ul style="list-style-type: none"> • Study Format "Distance Learning": Oral Assignment <p><u>Business Communication and Storytelling</u></p> <ul style="list-style-type: none"> • Study Format "Distance Learning": Concept Presentation

Weight of Module

see curriculum

Module Contents**Conversation Management and Communication Techniques**

- Forms of Communication
- Means of Communication Techniques of Communication
- Communication with Specific Groups Conversation Management
- Means in Conversation
- Dealing with Difficult Conversation Situations

Business Communication and Storytelling

The module will enable students to present information in an audience-centered way and to create "stories" out of numbers and data. This competence plays a significant role in an increasingly data-based world and helps to make numbers and data come alive and tangible and thus create a stronger impact internally and externally.

Learning Outcomes**Conversation Management and Communication Techniques**

On successful completion, students will be able to

- place the importance of the areas of communication techniques and interviewing in the overall context of business psychology,
- identify goals and forms of communication and interviewing in the context of business psychology,
- use and apply means, methods and instruments of communication and conversation in the context of business psychology,
- identify and understand purposeful communication and conversation management techniques against the backdrop of difficult and deadlocked situations,
- explain and develop appropriate measures of communication and conversation,
- discuss and uncover problems of communication and conversation and suggest alternative approaches.

Business Communication and Storytelling

On successful completion, students will be able to

- bring data to life through storytelling.
- apply storytelling methods to their own data.
- link emotions to data.
- build a presentation based on dramaturgy.
- use presentation techniques to reinforce the story.
- visualize data in an audience-centered way.

Links to other Modules within the Study Program

This module is similar to other modules in the fields of Social Work and Business & Management

Links to other Study Programs of the University

All Master Programs in the Social Sciences and Business Administration & Management fields

Conversation Management and Communication Techniques

Course Code: DLMWPGUK01_E

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

Course Description

Good communication skills are the key to professional success. To achieve professional goals, you have to be convincing in conversations. Only those who really understand their conversation partners and are also understood by them, will achieve a good result more quickly. To achieve this, it is essential to be prepared, especially for difficult conversations, and to have a toolbox of different conversation techniques at your disposal, so that can be used in a targeted manner to make constructive communication possible. In addition to certain means of communication, this also requires special techniques and methods. Knowledge and understanding of the psychological and human aspects of the use of communication techniques and the conduct of discussions are an important basis for the success of discussions in the context of business psychology. The course also addresses difficult and critical discussion situations as well as communication with specific target groups. Students learn about different communication styles, communication techniques as well as the phases of conducting discussions in order to specifically prepare for and conduct discussions with other team members as well as external partners. You will learn how to better adapt to your conversation partners and act accordingly in order to achieve good results for both sides.

Course Outcomes

On successful completion, students will be able to

- place the importance of the areas of communication techniques and interviewing in the overall context of business psychology,
- identify goals and forms of communication and interviewing in the context of business psychology,
- use and apply means, methods and instruments of communication and conversation in the context of business psychology,
- identify and understand purposeful communication and conversation management techniques against the backdrop of difficult and deadlocked situations,
- explain and develop appropriate measures of communication and conversation,
- discuss and uncover problems of communication and conversation and suggest alternative approaches.

Contents

1. Basics of Communication
 - 1.1 Defining and Characterizing Communication
 - 1.2 Modeling Communication
 - 1.3 Functions of Communication
 - 1.4 Communication Competence
2. Forms of Communication
 - 2.1 Types of Communication
 - 2.2 Modalities of Communication
 - 2.3 Verbal Communication
 - 2.4 Nonverbal Communication
3. Perception in the Communication Process
 - 3.1 Perception Process
 - 3.2 Perceiving Others
 - 3.3 Perceiving and Presenting Self
 - 3.4 Communicative Styles
4. Communication Techniques
 - 4.1 Listening
 - 4.2 Perspective Taking
 - 4.3 Questioning
 - 4.4 I-language
 - 4.5 Complete Messages
 - 4.6 Metacommunication
 - 4.7 Neuro Linguistic Programming Techniques
5. Communication at Work
 - 5.1 Communication in Dyads
 - 5.2 Communication in Teams
 - 5.3 Organizational Communication
 - 5.4 Communication with the Public
6. Conversation Strategies
 - 6.1 Shaping Relationships
 - 6.2 Handling Self-Disclosure
 - 6.3 Presenting Content

6.4	Employing Influence
6.5	Planning and Structuring Conversations
6.6	Problem-solving in groups
7.	Difficult Conversations
7.1	Conveying Difficult Content
7.2	Difficult Interaction Partners
7.3	Conflicts
7.4	Feedback Rules
8.	Public Communication
8.1	Types
8.2	Rhetorics
8.3	Preparing
8.4	Delivering
8.5	The influence of social media

Literature
Compulsory Reading
Further Reading
<ul style="list-style-type: none">▪ Adler, R. B., Rodman, G. R., & du Pré, A. (2017). <i>Understanding human communication</i> (13thed.). Oxford University Press.▪ <i>Communication in the real world: An introduction to communication studies</i>. (2016). University of Minnesota Libraries Publishing.▪ Hargie, O. (2017). <i>Skilled interpersonal communication: Research, theory and practice</i> (6thed.). Routledge.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Oral Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Business Communication and Storytelling

Course Code: DLMCOBCST01_E

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

Course Description

Never before has so much data been collected constantly and everywhere as today. On the one hand, data creates a basis for precise analysis - on the other hand, the flood of data also leads to confusion and excessive demands. Particularly in controlling, a lot of effort is put into compiling figures month after month to create analyses and forecasts and make data-driven decisions. The goal is to process data in an appealing way and to present it convincingly. This is where controllers often reach their limits, because at this point, they frequently encounter audiences who are under strong time pressure (management level), who do not have an affinity for numbers (customers) or to whom figures and plans have to be "sold" in such a way that they are willing to provide financing (banks and investors). This is where storytelling comes in handy as a method that helps to package figures and data in a story, to bring complex issues to the point and to provide them with suspense and emotions. Stories, metaphors, and the associated emotions not only focus attention, but also increase recall. They can enhance decisions by increasing persuasiveness, credibility, and trust.

Course Outcomes

On successful completion, students will be able to

- bring data to life through storytelling.
- apply storytelling methods to their own data.
- link emotions to data.
- build a presentation based on dramaturgy.
- use presentation techniques to reinforce the story.
- visualize data in an audience-centered way.

Contents

- The course covers the role of the storyteller in companies today, for executives and managers, for controllers and marketers. At the same time, aspects of creating meaning for internal and external communication through storytelling are developed. In the course, students focus on three key aspects: First, they develop instruments, methods, and concepts of storytelling and apply them. This includes the central building blocks of a story, the benefits and added value of storytelling, and fundamentals and concepts of data-based storytelling. Secondly, the students deal with options for creative visualization and design principles of data and apply these visualization techniques. The visualization approach depends on the audience and how well it supports the storyline. This includes creative

graphics for presentations, as well as effective and self-explanatory dashboard design. Third, students develop techniques and stylistic devices that authentically convey emotions and thus support the story, without appearing contrived. The learned content will be bundled and presented in a concept presentation.

Literature

Compulsory Reading

Further Reading

- Chapple, D., Pollock, N., & D'Adderio, L. (2022). From Pitching to Briefing: Extending Entrepreneurial Storytelling to New Audiences. *Organization Studies*, 43(5), 773–795. <https://doi-org.pxz.iubh.de:8443/10.1177/01708406211024564>
- Dykes, B. (2020). *Effective Data Storytelling : How to Drive Change With Data, Narrative and Visuals*. Wiley.
- Ikhsan, R. B., Muhammad, N. G., Faishal, M. R., Sutanto, W., Fernando, Y., & Susilo, A. (2022). Digital Storytelling and Intention to Donate Through Crowdfunding Platform. 2022 7th International Conference on Business and Industrial Research (ICBIR), Business and Industrial Research (ICBIR), 2022 7th International Conference On, 116–121. <https://doi-org.pxz.iubh.de:8443/10.1109/ICBIR54589.2022.9786491>
- Nussbaumer Knaflic, C. (2020). Data Storytelling - A New Trend to Improve Your Reporting. *Rethinking Finance*, 6, 60–65.
- Nussbaumer Knaflic, C. (2015). *Storytelling With Data: A Data Visualization Guide for Business Professionals*. Wiley.
- Roam, D. (2022). Tell More and Better Stories! People Grow Through Visual Storytelling (Including You). *HR Future*, 1, 20–23.
- Sakamoto, Y., Sallam, S., Salo, A., Leboe-McGowan, J., & Irani, P. (2022). Persuasive Data Storytelling With a Data Video During Covid-19 Infodemic: Affective Pathway to Influence the Users' Perception About Contact Tracing Apps in Less Than 6 Minutes. 2022 IEEE 15th Pacific Visualization Symposium (PacificVis), Pacific Visualization Symposium (PacificVis), 2022 IEEE 15th, PACIFICVIS, 176–180. <https://doi-org.pxz.iubh.de:8443/10.1109/PacificVis53943.2022.00028>
- Storr, W. & Clamp, J. (2020). *The Science of Storytelling*. Dreamscape Media, LLC.
- Vora, S. (2020). *The Power of Data Storytelling*. Sage.
- Wexler, S., Shaffer, J., & Cotgreave, A. (2017). *The Big Book of Dashboards*. Wiley.

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Concept Presentation

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Machine Learning and Deep Learning

Module Code: DLMCSEMLDL

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	<ul style="list-style-type: none"> ▪ DLMSAM01, DLMDSPWP01, DLMSML01 ▪ DLMSAM01, DLMDSPWP01 	MA	10	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 (Machine Learning) / Prof. Dr. Visieu Lac (Deep Learning)

Contributing Courses to Module

- Machine Learning (DLMSML01)
- Deep Learning (DLMSDL01)

Module Exam Type

Module Exam	Split Exam
	<p><u>Machine Learning</u></p> <ul style="list-style-type: none"> • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes <p><u>Deep Learning</u></p> <ul style="list-style-type: none"> • Study Format "myStudies": Oral Assignment • Study Format "Distance Learning": Oral Assignment

Weight of Module

see curriculum

<p>Module Contents</p> <p>Machine Learning</p> <ul style="list-style-type: none"> ▪ Supervised, unsupervised, and reinforcement learning approaches ▪ Regression and classification learning problems ▪ Estimation of functional dependencies via regression techniques ▪ Data clustering ▪ Support vector machines, large margin classification ▪ Decision tree learning <p>Deep Learning</p> <ul style="list-style-type: none"> ▪ Introduction to neural networks and deep learning ▪ Network architectures ▪ Neural network training ▪ Alternative training methods ▪ Further network architectures 	
<p>Learning Outcomes</p> <p>Machine Learning</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ know different machine learning model classes. ▪ comprehend the difference between supervised, unsupervised, and reinforcement learning methods. ▪ understand common machine learning models. ▪ analyze trade-offs in the application of different models. ▪ appropriately choose machine learning models according to a given task. <p>Deep Learning</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ comprehend the fundamental building blocks of neural networks. ▪ understand concepts in deep learning. ▪ analyze the relevant deep learning architecture in a wide range of application scenarios. ▪ create deep learning models. ▪ utilize alternative methods to train deep learning models. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Data Science & Artificial Intelligence.</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programmes in the IT & Technology field.</p>

Machine Learning

Course Code: DLMDSML01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMDSAM01, DLMDSPWP01

Course Description

Machine learning is a field of scientific study concerned with algorithmic techniques that enable machines to learn performance on a given task via the discovery of patterns or regularities in exemplary data. Consequently, its methods commonly draw upon a statistical basis in conjunction with the computational capabilities of modern computing hardware. This course aims to acquaint the student with the main branches of machine learning and provide a thorough introduction to the most widely used approaches and methods in this field.

Course Outcomes

On successful completion, students will be able to

- know different machine learning model classes.
- comprehend the difference between supervised, unsupervised, and reinforcement learning methods.
- understand common machine learning models.
- analyze trade-offs in the application of different models.
- appropriately choose machine learning models according to a given task.

Contents

1. Introduction to Machine Learning
 - 1.1 Regression & Classification
 - 1.2 Supervised & Unsupervised Learning
 - 1.3 Reinforcement Learning
2. Clustering
 - 2.1 Introduction to clustering
 - 2.2 K-Means
 - 2.3 Expectation Maximization
 - 2.4 DBScan
 - 2.5 Hierarchical Clustering
3. Regression
 - 3.1 Linear & Non-linear Regression

- 3.2 Logistic Regression
- 3.3 Quantile Regression
- 3.4 Multivariate Regression
- 3.5 Lasso & Ridge Regression
4. Support Vector Machines
 - 4.1 Introduction to Support Vector Machines
 - 4.2 SVM for Classification
 - 4.3 SVM for Regression
5. Decision Trees
 - 5.1 Introduction to Decision Trees
 - 5.2 Decision Trees for Classification
 - 5.3 Decision Trees for Regression
6. Genetic Algorithms
 - 6.1 Introduction to Genetic Algorithms
 - 6.2 Applications of Genetic Algorithms

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.
- Lahoz-Beltra, R. (2016). SGA: Simple Genetic Algorithm (SGA) in Python.
- Runkler, T. A. (2012). Data analytics: Models and algorithms for intelligent data analysis. Springer Vieweg Press.
- Skiena, S. S (2017). The data science design manual. Springer International Publishing. Database: Springer eBook Package English Computer Science.

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed <input checked="" type="checkbox"/> Intensive Live Sessions/Learning Sprint	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed <input checked="" type="checkbox"/> Intensive Live Sessions/Learning Sprint	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Deep Learning

Course Code: DLMDSDL01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMDSAM01, DLMDSPWP01, DLMDSML01

Course Description

Neural networks and deep learning approaches have revolutionized the fields of data science and artificial intelligence in recent years, and applications built on these techniques have reached or surpassed human performance in many specialized applications. After a short review of the origins of neural networks and deep learning, this course will cover the most common neural network architectures and discuss in detail how neural networks are trained using dedicated data samples, avoiding common pitfalls such as overtraining. The course includes a detailed overview of alternative methods to train neural networks and further network architectures which are relevant in a wide range of specialized application scenarios.

Course Outcomes

On successful completion, students will be able to

- comprehend the fundamental building blocks of neural networks.
- understand concepts in deep learning.
- analyze the relevant deep learning architecture in a wide range of application scenarios.
- create deep learning models.
- utilize alternative methods to train deep learning models.

Contents

1. Introduction to Neural Network and Deep Learning
 - 1.1 The Biological Brain
 - 1.2 Perceptron and Multi-Layer Perceptrons
2. Network Architectures
 - 2.1 Feed-Forward Networks
 - 2.2 Convolutional Networks
 - 2.3 Recurrent Networks, Memory Cells and LSTMs
3. Neural Network Training
 - 3.1 Weight Initialization and Transfer Function
 - 3.2 Backpropagation and Gradient Descent
 - 3.3 Regularization and Overtraining

4. Alternative Training Methods
 - 4.1 Attention
 - 4.2 Feedback Alignment
 - 4.3 Synthetic Gradients
 - 4.4 Decoupled Network Interfaces

5. Further Network Architectures
 - 5.1 Generative Adversarial Networks
 - 5.2 Autoencoders
 - 5.3 Restricted Boltzmann Machines
 - 5.4 Capsule Networks
 - 5.5 Spiking Networks

Literature**Compulsory Reading****Further Reading**

- Chollet, F. (2021). Deep learning with Python. 2nd edition. Shelter Island, NY. Manning Publications.
- Geron, A. (2022). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow. 3rd edition. Boston, MA, O'Reilly Media Inc.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. Boston, MA: MIT Press.
- Russel, S., & Norvig, P. (2022). Artificial intelligence – A modern approach (4th ed.). Essex. Pearson.

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Oral Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed <input checked="" type="checkbox"/> Intensive Live Sessions/Learning Sprint	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Oral Assignment

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed <input checked="" type="checkbox"/> Intensive Live Sessions/Learning Sprint	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Process Management with Scrum

Module Code: DLMPREEPMS

Module Type see curriculum	Admission Requirements <ul style="list-style-type: none"> ▪ none ▪ DLMPREEPMS01 	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Nebojsa Radojevic (Process Management with Scrum) / Prof. Dr. Nebojsa Radojevic (Project: Corporate Project with Scrum)

Contributing Courses to Module

- Process Management with Scrum (DLMPREEPMS01)
- Project: Corporate Project with Scrum (DLMPREEPMS02)

Module Exam Type

Module Exam

Split Exam

Process Management with Scrum

- Study Format "Distance Learning": Written Assessment: Case Study

Project: Corporate Project with Scrum

- Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

<p>Module Contents</p> <p>Process Management with Scrum</p> <ul style="list-style-type: none"> ▪ Scrum Origin, Basic Idea and Fields of Application ▪ Scrum Roles ▪ Product Backlog and Sprint Planning ▪ Executing the Scrum Process ▪ Helpful Tools ▪ Implementation and Scaling of Scrum <p>Project: Corporate Project with Scrum</p> <p>After studying the methods of Scrum and learning about the systematic development approach, this course offers the opportunity to transfer the learned contents to practice. Choosing a real project or task within an organization, the method can be experienced and compared to the theoretical concept.</p>	
<p>Learning Outcomes</p> <p>Process Management with Scrum</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ understand and explain the contents of the agile manifest. ▪ understand Scrum as a framework for developing, delivering, and sustaining products in a complex environment. ▪ describe each of the roles within a Scrum team and explain each item and each step within the Scrum process. ▪ handle the refinement process of the product backlog and discuss the interaction within the team and to the outside world during and after a sprint. ▪ understand the concept of user stories and apply the method to simple cases. ▪ understand and describe possibilities for the scaling of Scrum. <p>Project: Corporate Project with Scrum</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ understand Scrum and its roles within the context of a corporate organization. ▪ explain the elements and processes of Scrum in detail and out of practical experience. ▪ create user stories, refine the product backlog and select items for a sprint. ▪ collaborate in the daily scrum and apply the little tools within the development team. ▪ discuss critically the benefits and limitations of the Scrum framework. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other moduls in the field of Project Management</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the Business & Management field</p>

Process Management with Scrum

Course Code: DLMPREEPMS01

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

Course Description

Within the broad field of project management, Scrum falls into the category of agile methods. As such, Scrum is more of a process management framework than a project management method. In this course the Scrum framework will be described and discussed in detail. The Agile Manifesto will be introduced, and the basic idea of iterative and incremental development will be discussed, leading up to the methodology of Scrum. A thorough review will be done on the different roles within the Scrum team. The terms product backlog, refinement and increment are defined and explained. As core feature of Scrum, the execution of sprints and daily scrums will be detailed. For the practical application of Scrum, the handling of requirements and creation of user stories will be introduced. The student also gets to know the little tools for communication and task-tracking used within development teams. Furthermore, the student will learn when and how a Scrum process should be implemented and what kind of benefits and risks can be expected from it.

Course Outcomes

On successful completion, students will be able to

- understand and explain the contents of the agile manifest.
- understand Scrum as a framework for developing, delivering, and sustaining products in a complex environment.
- describe each of the roles within a Scrum team and explain each item and each step within the Scrum process.
- handle the refinement process of the product backlog and discuss the interaction within the team and to the outside world during and after a sprint.
- understand the concept of user stories and apply the method to simple cases.
- understand and describe possibilities for the scaling of Scrum.

Contents

1. Scrum Origin, Basic Idea and Fields of Application
 - 1.1 The Birth of Scrum – How and Why it All Began
 - 1.2 The Agile Manifesto and a Change in Perspective
 - 1.3 The Approach of Iterative and Incremental Development
 - 1.4 Defining Fields for Scrum and Fields for Not Scrum
2. Scrum Roles

- 2.1 The Development Team
- 2.2 The Product Owner
- 2.3 The Scrum Master
- 2.4 The Customer Involvement
- 2.5 The Organization

- 3. Product Backlog and Sprint Planning
 - 3.1 Principles of a Product Backlog
 - 3.2 Refinement Process
 - 3.3 Definition of Ready
 - 3.4 Determining Capacity
 - 3.5 Selecting Items and Defining the Sprint Goal

- 4. Executing the Scrum Process
 - 4.1 The Scrum Process
 - 4.2 Sprint Cycle
 - 4.3 Daily Scrum
 - 4.4 Sprint Review
 - 4.5 Sprint Retrospective

- 5. Helpful Tools
 - 5.1 Requirements and User Stories
 - 5.2 Planning Poker
 - 5.3 Communication Tools (e. g. Task Board)
 - 5.4 Tracking Tools (e. g. Burn-down Chart)
 - 5.5 Available Software Tools

- 6. Implementation and Scaling of Scrum
 - 6.1 Implementation of Scrum in a Company
 - 6.2 Chances, Risks, and Limitations of Scrum
 - 6.3 Scrum of Scrums
 - 6.4 The Nexus Framework for Scaling Scrum
 - 6.5 Other Approaches

Literature**Compulsory Reading****Further Reading**

- Highsmith, J. (2002). Agile software development ecosystems. Addison-Wesley Professional.
- Schwaber, K. (2004). Agile project management with Scrum. Microsoft Press.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Project: Corporate Project with Scrum

Course Code: DLMPREEPMS02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMPREEPMS01

Course Description

The course „Project: Corporate Project with Scrum” is building on the basic knowledge of the Scrum Framework acquired in the previous course. The theoretical foundations of Scrum can be applied within a real company environment. The student experiences the advantages of agile work and can reflect on the Scrum roles in practice. The student is also confronted with the hurdles that arise in applying the methodology in a real situation and can experiment with own approaches to solutions.

Course Outcomes

On successful completion, students will be able to

- understand Scrum and its roles within the context of a corporate organization.
- explain the elements and processes of Scrum in detail and out of practical experience.
- create user stories, refine the product backlog and select items for a sprint.
- collaborate in the daily scrum and apply the little tools within the development team.
- discuss critically the benefits and limitations of the Scrum framework.

Contents

- The course „Project: Corporate Project with Scrum” is building on the basic knowledge of the Scrum Framework acquired in the previous course and on the general knowledge of management know-how and classical project management acquired during the previous semesters. Based on a real task to be resolved within an organization (commercial enterprise, public administration, or the like), the students can gain practical experience working with agile methods utilizing the Scrum Framework.
- The students will reflect critically on the similarities and differences they observed and, if applicable, also compare the experienced agile methods with classical methods of project management. To meet scientific criteria, a literature search and a thorough comparison of the scientific and methodological foundation to the practical aspects experienced in the project is strongly encouraged and supported. The business aspect (costs, gain, time, quality, strategic relevance, etc.) of the project should be recognized and analyzed based on scientific methods. The students will demonstrate their ability to combine specialist knowledge and transfer of this knowledge to a specific project in a professional environment. They will also critically reflect on the experienced own work with Scrum, as well as on the theoretical concept of the Scrum Framework itself.

Literature**Compulsory Reading****Further Reading**

- Anon. (2001): Manifesto for Agile Software Development. (URL: <https://agilemanifesto.org> [Retrieved: 20.03.2021]).
- Ockerman, S./ Reindl, S. (2019): Mastering Professional Scrum: Coaches' Notes for Busting Myths, Solving Challenges, and Growing Agility. Addison Wesley Longman, Boston.
- Rubin, K. S. (2013): Essential Scrum: A Practical Guide to the Most Popular Agile Process. Addison-Wesley Professional, Boston.
- Schwaber, K. / Sutherland, J. V. (2012): Software in 30 days: How Agile Managers Beat the Odds, Delight their Customers and Leave Competitors in the Dust. Wiley, New Jersey.
- Sutherland, J. (2015): Scrum: The art of Doing Twice the Work in Half the Time. Random House UK, London.
- Verheyen, G. (2019): Scrum: A Pocket Guide: a Smart Travel Companion. 2nd edition, Van Haren Publishing, VW 's-Hertogenbosch.

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Internet of Things and Ethical Reflection in Management

Module Code: DLMNMWNEET_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimaldauer: 1 Semester	Regularly offered in	Language of Instruction and Examination English
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Module Coordinator

Rachel John Robinson (Internet of Things) / Prof. Dr. Karsten Hurrelmann (Seminar: Ethical Reflection in Management)

Contributing Courses to Module

- Internet of Things (DLMBMMIIT01)
- Seminar: Ethical Reflection in Management (DLMNMSERM01_E)

Module Exam Type

Module Exam

Split Exam

Internet of Things

- Study Format "Distance Learning": Exam, 90 Minutes
- Study Format "myStudies": Exam, 90 Minutes

Seminar: Ethical Reflection in Management

- Study Format "Distance Learning": Written Assessment: Research Essay

Weight of Module

see curriculum

Module Contents

Internet of Things

- Consumer use cases and risks
- Business use cases and risks
- Social-economic issues
- Enabling technologies and networking fundamentals

Seminar: Ethical Reflection in Management

In this course, real-life challenges from business practice of different industries are brought to the attention of the students. With the help of ethical reflection as well as the development of proposed solutions, processes and business models, the overcoming of trade-off thinking between profit and sustainability will be promoted.

Learning Outcomes

Internet of Things

On successful completion, students will be able to

- distinguish and discuss a broad range of use cases for the internet of things (IoT).
- understand and reflect upon the different perspectives on IoT.
- apply distinct techniques to engineer internet-of-things products.
- evaluate and identify appropriate IoT communication technology and standards according to given IoT product requirements.
- reflect on the respective theoretical foundation, evaluate different approaches, and apply appropriate approaches to practical questions and cases.

Seminar: Ethical Reflection in Management

On successful completion, students will be able to

- develop an understanding of various ontological approaches and applications to economics.
- apply their knowledge of various ethical theories and approaches to management and current discussions.
- develop approaches to identify, reflect on, and overcome trade-offs.
- build an appropriate analytical framework of reflection for evaluating business challenges.

Links to other Modules within the Study Program

This module is similar to other modules in the field of Computer Science & Software Development and Business Administration & Management

Links to other Study Programs of the University

All Master Programs in the IT & Technology field

Internet of Things

Course Code: DLMBMMIIT01

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

Course Description

The Internet of Things (IoT), once a rough vision, has become reality today in a broad manner. There is a plethora of devices and services available to both consumers and businesses. From smart homes to smart cities, from smart devices to smart factories – internet-of-things technologies impact on our lives and environments. This course follows a top-down approach, discussing a broad set of aspects connected with the internet of things. It starts with use cases and risks from the perspectives of customers and businesses and winds up with a technical foundation of the internet of things. To address the engineering perspective, a set of techniques is proposed.

Course Outcomes

On successful completion, students will be able to

- distinguish and discuss a broad range of use cases for the internet of things (IoT).
- understand and reflect upon the different perspectives on IoT.
- apply distinct techniques to engineer internet-of-things products.
- evaluate and identify appropriate IoT communication technology and standards according to given IoT product requirements.
- reflect on the respective theoretical foundation, evaluate different approaches, and apply appropriate approaches to practical questions and cases.

Contents

1. Introduction into the Internet of Things
 - 1.1 Foundations and Motivations
 - 1.2 Potential and Challenges
2. Social and Business Relevance
 - 2.1 Innovations for Consumers and Industry
 - 2.2 Impact on Human and Work Environment
 - 2.3 Privacy and Security
3. Architectures of Internet of Things and Industrial Internet of Things
 - 3.1 Elements of IoTs and IIoTs
 - 3.2 Sensors and Nodes

- 3.3 Power Systems
- 3.4 Fog Processors
- 3.5 Platforms
4. Communication Standards and Technologies
 - 4.1 Network Topologies
 - 4.2 Network Protocols
 - 4.3 Communication Technologies
5. Data Storage and Processing
 - 5.1 NoSQL and MapReduce
 - 5.2 Linked Data and RDF(S)
 - 5.3 Semantic Reasoning
 - 5.4 Complex Event Processing
 - 5.5 Machine Learning
 - 5.6 Overview of Existing Data Storage and Processing Platforms
6. Fields of Application
 - 6.1 Smart Home/Living
 - 6.2 Smart Buildings
 - 6.3 Ambient Assisted Living
 - 6.4 Smart Energy/Grid
 - 6.5 Smart Factory
 - 6.6 Smart Logistics
 - 6.7 Smart Healthcare
 - 6.8 Smart Agriculture

Literature**Compulsory Reading****Further Reading**

- Lea, P. (2018). Internet of things for architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security. Birmingham: Packt Publishing Ltd. (Database: Dawson).
- McEwen, A., & Cassimally, H. (2013). Designing the internet of things. Chichester: John Wiley & Sons. (Database: ProQuest).
- Raj, P., & Raman, A. C. (2017). The Internet of Things: Enabling technologies, platforms, and use cases. Boca Raton, FL: Auerbach Publications. (Database: ProQuest).
- Weber, R. H., & Weber, R. (2010). Internet of Things. Heidelberg: Springer. (Database: Dawson).

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Seminar: Ethical Reflection in Management

Course Code: DLMNMSERM01_E

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

Course Description

In this course, economic-philosophical and epistemological thinking and action will be applied in a practice-oriented manner. Ethics in the sense of reflecting on one's own possibilities for action should show students new perspectives for problem solving. Current approaches to theories of science and their application in management are discussed and an ethical model of reflection is developed. This should help the students to find their own concrete fields of application and to develop solution strategies. The aim is to overcome the classic trade-off thinking between economic efficiency and ethical demands and thus to promote an integrative mindset in the students thinking and acting.

Course Outcomes

On successful completion, students will be able to

- develop an understanding of various ontological approaches and applications to economics.
- apply their knowledge of various ethical theories and approaches to management and current discussions.
- develop approaches to identify, reflect on, and overcome trade-offs.
- build an appropriate analytical framework of reflection for evaluating business challenges.

Contents

- Current developments in philosophy of science and philosophy: Overview of various ontological approaches and applications to economics.
- Overview of various ethical theories and approaches to management and current discussions thereof.

Literature**Compulsory Reading****Further Reading**

- Glauner, F. (2016): CSR and value cockpits. Measurement and control systems of corporate culture. 2nd edition, Gabler Verlag, Berlin.
- Schneider, A./Schmidpeter, R. (2015): Corporate Social Responsibility. Responsible Corporate Governance in Theory and Practice. 2nd edition, Gabler Verlag, Berlin.
- Von Müller, A. (2020): The self-development of the world. An invitation to rethink time and reality and to deal with complexity differently. 1st edition, Siedler Verlag. München.
- Wieland, J. (2014): Governance Ethics: Global value creation, economic organization and normativity. 1. Auflage, Springer International Publishing, Switzerland.

Study Format Distance Learning

Study Format Distance Learning	Course Type Seminar
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Research Essay

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

IT Services and Architecture Management

Module Code: DLMDCCEISAM

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimaldauer: 1 Semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Andrew Adjah Sai (Management of IT Services and Architecture) / Prof. Dr. Carsten Skerra (IT Architecture Management)

Contributing Courses to Module

- Management of IT Services and Architecture (MWIT02-01_E)
- IT Architecture Management (DLMBITPAM02)

Module Exam Type

Module Exam	Split Exam <u>Management of IT Services and Architecture</u> <ul style="list-style-type: none"> • Study Format "Distance Learning": Exam, 90 Minutes <u>IT Architecture Management</u> <ul style="list-style-type: none"> • Study Format "Distance Learning": Written Assessment: Case Study • Study Format "myStudies": Written Assessment: Case Study
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Weight of Module

see curriculum

Module Contents**Management of IT Services and Architecture**

- Basics of IT Service Management and Terminolog
- IT Infrastructure Library (ITIL)
- IT Outsourcing
- IT Architecture Management
- IT Application Portfolio Management
- Structural Organization of IT and Architecture Governance

IT Architecture Management

- Architecture documentation
- Architecture governance
- Enterprise architecture management (EAM)
- IT application portfolio management
- Enterprise architecture patterns
- Architecture framework: TOGAF

Learning Outcomes**Management of IT Services and Architecture**

On successful completion, students will be able to

- name, explain and distinguish the basic principles of IT strategy, IT governance and IT architecture management.
- explain and differentiate between the typical activities of IT architecture management, their interrelationships and their dependencies.
- explain the fundamentals and challenges of IT service management.
- describe the motivation and structure of the IT Infrastructure Library (ITIL), explain the main elements and locate specific activities in the service lifecycle.

IT Architecture Management

On successful completion, students will be able to

- understand that having a well-defined IT architecture blueprint in place is key to success for IT organizations.
- analyze the constraints of existing application, infrastructure and information/ data architectures.
- know different types of IT application portfolio management.
- manage enterprise architecture patterns proactively.
- understand how to initiate change requests in order to modify or extend the IT architecture if the introduction or modification of a service is not possible within a given framework.

<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Computer Science & Software Development</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the IT & Technology fields</p>
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Management of IT Services and Architecture

Course Code: MWIT02-01_E

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

Course Description

IT service management is an approach to align and understand a company's IT as a service provider and supporter of operational and business processes. Here, the focus is on quality management and handling of daily operations. In addition to specific IT projects, e.g., the development of an IT system or the introduction of standard software, strategic management must be used for the organization-wide IT infrastructure. The task of IT architecture management is the strategic alignment of the IT infrastructure with the organization's business and IT strategy. This course provides concepts, methods, procedures and models for the tasks within the scope of IT architecture management.

Course Outcomes

On successful completion, students will be able to

- name, explain and distinguish the basic principles of IT strategy, IT governance and IT architecture management.
- explain and differentiate between the typical activities of IT architecture management, their interrelationships and their dependencies.
- explain the fundamentals and challenges of IT service management.
- describe the motivation and structure of the IT Infrastructure Library (ITIL), explain the main elements and locate specific activities in the service lifecycle.

Contents

1. IT Service Management Basics and Terms
 - 1.1 IT Services
 - 1.2 IT Service Management
 - 1.3 ITSM Frameworks
2. ITIL 4 - Basics and Four Dimensions
 - 2.1 Stakeholders, Services and Service Management
 - 2.2 Value Contribution of IT
 - 2.3 Four Dimensions Model
3. ITIL 4 - Service Value System
 - 3.1 Basics and Overview

- 3.2 Inputs, Outcome and Governance
- 3.3 The Service Value Chain
- 3.4 Continual Improvement
- 4. ITIL 4 - Principles
 - 4.1 Overview
 - 4.2 Value Orientation
 - 4.3 Iterative Procedure and Feedback
 - 4.4 Establish Collaboration and Visibility
 - 4.5 Optimize and Automate
- 5. ITIL 4 - Practices
 - 5.1 Overview
 - 5.2 General Management Practices
 - 5.3 Service Management Practices
 - 5.4 Technical Practices
- 6. IT Architecture Management Basics and Terms
 - 6.1 IT Enterprise Architecture
 - 6.2 Goals of Enterprise Architecture Management
 - 6.3 Processes in the Management of IT Enterprise Architectures
- 7. IT Application Portfolio Management
 - 7.1 Overview of IT Application Portfolio Management
 - 7.2 Application Manual
 - 7.3 Portfolio Analysis
 - 7.4 Development Planning
- 8. Architecture Governance
 - 8.1 Organizational Structure
 - 8.2 Policy Development and Enforcement
 - 8.3 Project Support

Literature
Compulsory Reading
Further Reading <ul style="list-style-type: none">▪ Agutter, C. (2019). ITIL® foundation essentials ITIL 4 edition: The ultimate revision guide. ITGovernance Publishing.▪ Axelos Limited. (2019). ITIL 4 foundation: ITIL 4 edition. The Stationery Office.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

IT Architecture Management

Course Code: DLMBITPAM02

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

Course Description

The course IT Architecture Management aims to enable students to define a blueprint for the future development of a particular IT landscape, taking into account service strategies and available technologies given to an IT service provider.

Course Outcomes

On successful completion, students will be able to

- understand that having a well-defined IT architecture blueprint in place is key to success for IT organizations.
- analyze the constraints of existing application, infrastructure and information/ data architectures.
- know different types of IT application portfolio management.
- manage enterprise architecture patterns proactively.
- understand how to initiate change requests in order to modify or extend the IT architecture if the introduction or modification of a service is not possible within a given framework.

Contents

1. Introduction to IT Architectures
 - 1.1 The Term "Architecture" in the Context of IT
 - 1.2 Use Cases and Levels of IT Architectures
 - 1.3 Overview on IT Architecture Management
2. Enterprise Architecture Management (EAM)
 - 2.1 IT-Strategy
 - 2.2 Enterprise Architecture
 - 2.3 Roles and Activities in EAM
3. IT Application Portfolio Management
 - 3.1 Application Handbook
 - 3.2 Portfolio Analyses
 - 3.3 Planning the Application Landscape

4. Architecture Framework: TOGAF
 - 4.1 Purpose and Overview on TOGAF
 - 4.2 Architecture Development Method (ADM)
 - 4.3 Guidelines & Techniques
 - 4.4 Architecture Content Framework
 - 4.5 Architecture Capability Framework
5. Architecture Documentation
 - 5.1 Structures, Components, and Interfaces
 - 5.2 Processes and Applications
 - 5.3 Domain Architecture
6. Architecture Governance
 - 6.1 Roles and Committees
 - 6.2 Processes and Decisions
 - 6.3 Management of Architectural Policies
7. Enterprise Architecture Patterns
 - 7.1 Structures, Components, and Interfaces
 - 7.2 Processes and Applications
 - 7.3 Domain Architecture

Literature

Compulsory Reading

Further Reading

- Hanschke, I. (2010). Strategic IT Management: a Toolkit for Enterprise Architecture Management. Springer.
- Perroud, T., & Inversini, R. (2013). Enterprise architecture patterns [electronic resource] : practical solutions for recurring IT-architecture problems. Springer.
- The Open Group Architecture Framework. (2018). TOGAF 9.2 (Chs. 2, 4, 17, 29, 35, scan Chs. 5–16, scan Ch. 18–28, scan Chs. 36–38).

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book	Exam Preparation <input checked="" type="checkbox"/> Online Tests

Project Management within Operations

Module Code: DLMPREEMO

Module Type see curriculum	Admission Requirements None	Study Level MBA MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Sebastian Stütz (Operations and Information Management) / Prof. Dr. Margit Sarstedt (Project: Operations Projects)

Contributing Courses to Module

- Operations and Information Management (DLMBAEOIM01)
- Project: Operations Projects (DLMPREEMO02)

Module Exam Type

Module Exam	Split Exam
	<p><u>Operations and Information Management</u></p> <ul style="list-style-type: none"> • Study Format "myStudies": Written Assessment: Case Study • Study Format "Distance Learning": Written Assessment: Case Study <p><u>Project: Operations Projects</u></p> <ul style="list-style-type: none"> • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents**Operations and Information Management**

- Preparation of Reliable Demand Forecasts
- Site Planning
- Process Design and Process Planning
- Inventory Management and Production Control
- Information Systems in the Supply Chain
- Behavioral Operations Management

Project: Operations Projects

The course is building on the basic knowledge of operations and information management as well as on general project management know-how. The students apply a selection of the learned methods in a project for improvement or change within the Operations unit of a company. The special challenges of running a project in the context of existing day-to-day routines is experienced.

Learning Outcomes**Operations and Information Management**

On successful completion, students will be able to

- apply selected and practice-oriented concepts of operations management in various tasks and draw appropriate conclusions for verifiable performance improvements.
- critically evaluate the benefits and limitations of modern and process-oriented software solutions in operations management.
- consider current and future developments in connection with the megatrends of digitization and climate protection in operations management.
- support the analysis, planning, and design of value-adding processes in supply chains through modern information systems.
- understand and anticipate the behavior of decision-makers and their individual preferences in order to better predict the actual behavior of the supply chain partners and optimize the achievement of own objectives.

Project: Operations Projects

On successful completion, students will be able to

- describe and explain the real-life operational work of a company.
- understand the implications of information management.
- analyze needs and opportunities for improvement of specific operational processes.
- define and set up a project within the operational environment.
- implement an improvement or change in operational processes.

<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Business Administration & Management</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the Business & Management field</p>
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Operations and Information Management

Course Code: DLMBAEOIM01

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

Course Description

Operations management comprises the planning, control, execution, and monitoring of all internal company resources and capacities for the manufacture of products and services. This course provides students with the knowledge and skills to apply theoretically-sound and practice-relevant concepts of operations management in the context of different problems and tasks (taking into account central megatrends) and draw process-relevant conclusions for verifiable performance improvements. The consideration of powerful software solutions plays an important role here. Starting from the creation of reliable demand forecasts, different scenarios for the optimal location decisions of companies are considered. The process design defines the basic framework for processes, decision rules, and process performance analyses. This then shows in the subsequent process planning how optimal sequences for orders are calculated under certain priority rules. In inventory management, various models for inventory optimization are considered in order to apply practice-relevant methods for calculating capacities and production plans, taking into account various restrictions. Supply chain management investigates how independent companies can optimally coordinate their activities and promote cross-company communication through the use of sustainable information systems. Concluding the course is an examination of human decision heuristics and preferences and their anticipation of decision behavior within the framework of behavioral operations management.

Course Outcomes

On successful completion, students will be able to

- apply selected and practice-oriented concepts of operations management in various tasks and draw appropriate conclusions for verifiable performance improvements.
- critically evaluate the benefits and limitations of modern and process-oriented software solutions in operations management.
- consider current and future developments in connection with the megatrends of digitization and climate protection in operations management.
- support the analysis, planning, and design of value-adding processes in supply chains through modern information systems.
- understand and anticipate the behavior of decision-makers and their individual preferences in order to better predict the actual behavior of the supply chain partners and optimize the achievement of own objectives.

Contents

1. Introduction to operations management
 - 1.1 Definition, subjects, and tools of operations management
 - 1.2 Operations management under circumstances of conflicting demands
2. Preparation of reliable demand forecasts
 - 2.1 The Forecast Problem
 - 2.2 Qualitative forecasting methods
 - 2.3 Causal and time series forecasts
 - 2.4 Assessment of forecast quality
3. Site planning
 - 3.1 Central problem aspects
 - 3.2 Arbitrary locations and transport costs
 - 3.3 Optimization with pre-determined locations
 - 3.4 Site selection and response times
4. Process design and process planning
 - 4.1 Process types
 - 4.2 Process structure
 - 4.3 Process performance
 - 4.4 Priority rules for planning and controlling processes
5. Inventory management and production control
 - 5.1 Models for optimizing stocks
 - 5.2 Continuous inventory management
 - 5.3 Function and application areas of MRP II and Just in Time
 - 5.4 Methods for optimal planning of capacities and production plans
6. Information systems in the supply chain
 - 6.1 Increased performance through product and process design
 - 6.2 Order policy, demand forecasts, and demand planning
 - 6.3 Hellingrath and Kuhn's three-pillar approach
 - 6.4 Requirements for supply chain information systems
 - 6.5 Market analysis of selected IT systems
7. Behavioral operations management
 - 7.1 Decision heuristics for solving complex problems
 - 7.2 Decision behavior and decision prognosis

7.3 Decision influencing

Literature**Compulsory Reading****Further Reading**

- Bozarth, C. C. & Handfield, R. B. (2019). Introduction to operations and supply chain management (5th ed.). Pearson Education Limited.
- Das, A. (2015). An introduction to operations management: The joy of operations. Routledge.
- Hill, A., & Hill, T. (2018). Essential operations management (2nd ed.). Red Globe Press.
- Slack, N. & Brandon-Jones, A. (2018). Operations and process management: Principles and practice for strategic impact. Pearson.

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

Project: Operations Projects

Course Code: DLMPREPMO02

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

Course Description

Operational processes have the characteristics of running an operation in steady state, without allowing changes to the work processes in place. Any project in the Operations arena must therefore be either an improvement or a change project. After analyzing needs for improvement in specific operational processes using methods of operations and information management, project management can be applied to initiate changes. The project definition and execution must consider the specifics of daily business in an operational environment.

Course Outcomes

On successful completion, students will be able to

- describe and explain the real-life operational work of a company.
- understand the implications of information management.
- analyze needs and opportunities for improvement of specific operational processes.
- define and set up a project within the operational environment.
- implement an improvement or change in operational processes.

Contents

- The course is building on the basic knowledge of operations and information management and on general project management know-how. As operational processes have the characteristics of running an operation in steady state, any project within Operations must address either an improvement or a change to the existing processes. After analyzing possible needs for improvement in specific operational processes – applying the structured analytical methodologies commonly used in operations management – appropriate project management methods can be applied to initiate the identified changes. The project definition and execution must consider the specifics of daily business in an operational environment. The students can gain practical experience in setting up and running a project without noticeably interrupting the ongoing operational processes.
- During their work, the students will have the opportunity to compare their real-life experience with the theoretical concepts. The students will reflect critically on the similarities and differences they observed. To meet scientific criteria, a literature search and a thorough comparison of the scientific and methodological foundation to the practical aspects experienced in the project is strongly encouraged and supported. The business aspect (costs, gain, time, quality, strategic relevance, etc.) as outcome of the analysis and as

project result should be recognized and discussed based on scientific methods. The students will demonstrate their ability to combine specialist knowledge and transfer of this knowledge to a specific project in a professional environment

Literature

Compulsory Reading

Further Reading

- Bozarth, C. C./Handfield, R. B. (2019): Introduction to operations and supply chain management. Pearson, Harlow, England.
- Carvalho, A. M./Sampaio, P./Rebentisch, E. (2019): On Agile Metrics for Operations Management: Measuring and Aligning Agility with Operational Excellence. In: 2019 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), 1601–1605.
- Project Management Institute (2017): PMBOK Guide. A guide to the project management body of knowledge. Sixth edition, PA: Project Management Institute, Newtown Square.
- Slack, N./Brandon-Jones, A. (2018): Operations and process management. Principles and practice for strategic impact. Harlow, England Pearson Education Limited, 2018.

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

Management Consulting

Module Code: MWBC-01_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Hashem Zarafat (Management Consulting I) / Hashem Zarafat (Management Consulting II)

Contributing Courses to Module

- Management Consulting I (MWBC01-01_E)
- Management Consulting II (MWBC02-01_E)

Module Exam Type

Module Exam

Split Exam

Management Consulting I

- Study Format "Distance Learning": Exam, 90 Minutes

Management Consulting II

- Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

<p>Module Contents</p> <p>Management Consulting I</p> <ul style="list-style-type: none"> ▪ Management Consulting as a Professional Service ▪ Market Segments and Characteristics ▪ Typical Reasons and Situations for Consulting Usage ▪ Consulting Organizations and Business Models ▪ Consulting Projects and Project Management ▪ Effective Reasoning ▪ Effective Communication <p>Management Consulting II</p> <ul style="list-style-type: none"> ▪ Porter’s Generic Strategies ▪ Segmentation and Portfolio Analysis ▪ Optimizing Operations ▪ Investment Decisions ▪ Innovation and Disruption ▪ Putting Everything into Practice: Case for Self-Study 	
<p>Learning Outcomes</p> <p>Management Consulting I</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ describe the principle importance of management consulting for the economy as a whole and companies representing the supply side of the economy. ▪ understand what drives demand for consulting services and why consultants are employed. ▪ explain set-up and business model of consulting firms and how consulting projects are conducted. ▪ master selected principles of analytical thinking as well as effective communication. <p>Management Consulting II</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ understand the generic strategic positionings companies can adopt and how these positionings link to the industry life cycle. ▪ apply some of the fundamental concepts and tools management consultants use to support clients in adopting either of the principle strategic positionings. ▪ apply the combined body of knowledge to a complex business problem and derive actionable recommendations for action. 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field of Business Administration & Management</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programs in the Business & Management field</p>

Management Consulting I

Course Code: MWBC01-01_E

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

Course Description

Economies can be viewed as self-regulating entities in which innovations give rise to Creative Disruption. This leads to a continuous reconstruction of economies such that new businesses replace old businesses leading to new ways of value creation (Schumpeter, 1934). Economic participants employ management consultants to help them drive and manage this creative disruption and the corresponding change. In doing so, management consultants increase the competitiveness of their clients. The contributions of management consulting at the level of individual companies and the economy as a whole are therefore evident and companies themselves have adopted consulting methods in their standard tool set. Management consultants need a differentiated profile of professional-methodical and personal-social competencies. Professional competencies include a profound knowledge of relevant analytical methods and tools as well as basic and specialized knowledge of business management and strategic management. This is complemented by a profound understanding of markets and social and economic developments. Consultants must be able to plan and implement consulting projects for sustainable corporate value enhancement on the basis of strategic concepts and to monitor their success. Personal and social competencies complement their technical and methodological skills. They enable consultants to understand client expectations, to tailor consulting concepts to individual consulting needs and to actively shape consultant-client relationships in the sense of a value-adding performance partnership. In Management Consulting I, students learn why companies hire consultants and how consulting firms and projects are set-up and managed. In addition, students are exposed to selected fundamental tools of logical reasoning and effective communication that form the basis of the day-to-day work of consultants.

Course Outcomes

On successful completion, students will be able to

- describe the principle importance of management consulting for the economy as a whole and companies representing the supply side of the economy.
- understand what drives demand for consulting services and why consultants are employed.
- explain set-up and business model of consulting firms and how consulting projects are conducted.
- master selected principles of analytical thinking as well as effective communication.

Contents

1. Management Consulting as a Professional Service

- 1.1 Definition and Disambiguation
- 1.2 History of Management Consulting
- 1.3 Megatrends as Drivers for Consulting Services
- 1.4 Description of Market Segments and Major Players

- 2. Typical Reasons and Situations for Consulting Usage
 - 2.1 Complementing Managerial Resources: Capacity, Skill, and Expertise
 - 2.2 Manifest Crises: Strategy, Profitability, and Liquidity Crises
 - 2.3 Justification and Second Opinion: Workforce, Owners, and General Public

- 3. Consulting Organizations and Business Models
 - 3.1 Business Models and Organizational Set-ups
 - 3.2 Key Success Factors: Insight-Impact-Trust and Recruiting
 - 3.3 Contractual and Ethical Considerations

- 4. Consulting Projects and Project Management
 - 4.1 The Consulting Project: Set-up and Execution
 - 4.2 Project Management: How Consultants Get Organized
 - 4.3 Evaluation: Do Good and Talk About It

- 5. Effective Reasoning
 - 5.1 Encompassing the World: The MECE concept
 - 5.2 The Art of Reasoning: Deduction and Induction
 - 5.3 Finding Interdependencies: Correlation and Causal Relationships

- 6. Effective Communication
 - 6.1 Graphical Representations of Information
 - 6.2 Principles of Good Slide Design
 - 6.3 The Pyramid Principle and the Elevator Speech

Literature**Compulsory Reading****Further Reading**

- Bono, E. de. (repr 2002, 1982): De Bono's Thinking Course (new edition): Powerful Tools to Transform Your Thinking. rev. and updated ed., BBC Books, London.
- Christensen, C. M./ Wang, D./ van Bever, D. (2013): Consulting on the Cusp of Disruption: Competitive Strategy. Harvard Business Review 91, no. 10: 106-114.
- Minto, B. (2001): The pyramid principle: Present your thinking so clearly that the ideas jump off the page and into the reader's mind. 3rd ed., FT Publishing International, New Jersey.
- Schumpeter, J. A. (1934): The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Harvard economic studies: vol. XLVI. Harvard University Press, Cambridge.
- Zelazny, G. (2013). Say it with charts: The executive's guide to visual communication. 4th edition, McGraw-Hill Professional, New York.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Management Consulting II

Course Code: MWBC02-01_E

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

Course Description

Economies can be viewed as self-regulating entities in which innovations give rise to Creative Disruption. This leads to a continuous reconstruction of economies such that new businesses replace old businesses leading to new ways of value creation (Schumpeter, 1934). Economic participants employ management consultants to help them drive and manage this creative disruption and the corresponding change. In doing so, management consultants increase the competitiveness of their clients. The contributions of management consulting at the level of individual companies and the economy as a whole are therefore evident and companies themselves have adopted consulting methods in their standard tool set. Management consultants need a differentiated profile of professional-methodical and personal-social competencies. Professional competencies include a profound knowledge of relevant analytical methods and tools as well as basic and specialized knowledge of business management and strategic management. This is complemented by a profound understanding of markets and social and economic developments. Consultants must be able to plan and implement consulting projects for sustainable corporate value enhancement on the basis of strategic concepts and to monitor their success. Personal and social competencies complement their technical and methodological skills. They enable consultants to understand client expectations, to tailor consulting concepts to individual consulting needs and to actively shape consultant-client relationships in the sense of a value-adding performance partnership. In Management Consulting II, case examples are used to familiarize students with the standard tool set of management consultants to solve typical business problems and make appropriate recommendations for action. At the end of the course, student groups get the chance to apply their combined knowledge to a complex business case and present and discuss their findings during the course tutorial.

Course Outcomes

On successful completion, students will be able to

- understand the generic strategic positionings companies can adopt and how these positionings link to the industry life cycle.
- apply some of the fundamental concepts and tools management consultants use to support clients in adopting either of the principle strategic positionings.
- apply the combined body of knowledge to a complex business problem and derive actionable recommendations for action.

Contents

1. Porter's Generic Strategies
 - 1.1 The Principle Strategic Positionings
 - 1.2 Industry Life Cycle
 - 1.3 The Importance of Economies of Scale and Experience Curve
 - 1.4 Tools for Assessment: SWOT and 5-Forces
2. Segmentation and Portfolio Analysis
 - 2.1 Principles of Segmentation
 - 2.2 The BCG-Matrix and Its Applications
 - 2.3 Other Approaches to Portfolio Analysis
3. Optimizing Operations
 - 3.1 Working Capital Management and the Cash Conversion Cycle
 - 3.2 Complexity Reduction: The Pareto Principle and Its Applications
 - 3.3 De-Bottlenecking: Theory of Constraints
4. Investment Decisions
 - 4.1 Relevant Costs in Decision Making
 - 4.2 Decisions on Marginal Revenue Considerations
 - 4.3 Cashflow Return on Investment
5. Innovation and Disruption
 - 5.1 Blue Ocean Strategies
 - 5.2 10-Types of Innovation
 - 5.3 Decisions under Uncertainty: Scenario Planning
6. Putting Everything into Practice: Case for Self-Study
 - 6.1 Case Description
 - 6.2 Guiding Questions

Literature**Compulsory Reading****Further Reading**

- Goldratt, E. M./ Cox, J. (1993): The goal: A process of ongoing improvement. 2nd rev. ed., Gower, Aldershot.
- Juran, J. M. (1995): Managerial breakthrough: The classic book on improving management performance. Rev. ed., internat. ed., McGraw-Hill, New Jersey.
- Keeley, L. (2013): Ten types of innovation: The discipline of building breakthroughs. John Wiley & Sons, New Jersey.
- Kim, W. C. / Mauborgne, R. (2015): Blue ocean strategy: How to create uncontested market space and make the competition irrelevant. revised and expanded edition, Harvard business School Press, Cambridge.
- Porter, M. E. (1998): Competitive advantage: Creating and sustaining superior performance: with a new introduction. 2nd ed., Free Press, New York

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

E-Commerce

Module Code: MWEC-01_E

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Jonas Polfuß (E-Commerce I) / Prof. Dr. Jonas Polfuß (E-Commerce II)

Contributing Courses to Module

- E-Commerce I (MWEC01-01_E)
- E-Commerce II (MWEC02-01_E)

Module Exam Type

Module Exam

Split Exam

E-Commerce I

- Study Format "Distance Learning": Exam, 90 Minutes

E-Commerce II

- Study Format "Distance Learning": Written Assessment: Case Study

Weight of Module

see curriculum

Module Contents

E-Commerce I

- Basics of e-business and e-commerce
- Forms of e-commerce
- Strategic options in e-commerce
- Development of e-commerce strategies
- Measurement of success and success factors in e-commerce
- Risk benefit in e-commerce
- E-commerce in selected sectors

E-Commerce II

- Basics of online marketing and e-commerce
- web usability
- Network-based payment systems
- Legal basis
- Shop systems - tools - logistics
- Social media marketing in e-commerce
- Monitoring and analysis

Learning Outcomes**E-Commerce I**

On successful completion, students will be able to

- explain the basics and theory of e-commerce.
- know analysis methods for the economic management of e-commerce.
- classify the terms e-commerce and e-business.
- explain alternative strategies and instruments of e-commerce, implement them and check their influence on success.
- work with chances and possibilities of the internet in connection with e-commerce.
- know current business models and use this knowledge to find additional distribution channels.
- analyze e-commerce from a management perspective and prepare well-founded decision documents.
- know the sectoral characteristics of e-commerce, especially how e-commerce is structured in the B2B and capital goods sector and what has to be considered in the consumer goods industry (B2C).

E-Commerce II

On successful completion, students will be able to

- assess the potential of an online shop to successfully sell products and services over the Internet.
- know the conceptual, technical and legal aspects of e-commerce
- describe important prerequisites for success in e-commerce such as product range presentation, checkout and payment processes, conversion rate, etc.
- know selection criteria for shop systems and know the most important ones (Hybris, Magento etc.)
- explain current and future challenges, so that they can implement e-shop and e-commerce projects themselves.

Links to other Modules within the Study Program

This module is similar to other modules in the field of E-Commerce

Links to other Study Programs of the University

All Master Programs in the Marketing & Communication fields

E-Commerce I

Course Code: MWEC01-01_E

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

Course Description

This course addresses the topic of e-commerce. In addition to basic technical terms, concepts, business models and players, the opportunities and risks of electronic commerce within market-related and legal frameworks are also introduced. Based on this, the possible strategic options in e-commerce are presented in detail, on the basis of which students can derive their own e-commerce strategy.

Course Outcomes

On successful completion, students will be able to

- explain the basics and theory of e-commerce.
- know analysis methods for the economic management of e-commerce.
- classify the terms e-commerce and e-business.
- explain alternative strategies and instruments of e-commerce, implement them and check their influence on success.
- work with chances and possibilities of the internet in connection with e-commerce.
- know current business models and use this knowledge to find additional distribution channels.
- analyze e-commerce from a management perspective and prepare well-founded decision documents.
- know the sectoral characteristics of e-commerce, especially how e-commerce is structured in the B2B and capital goods sector and what has to be considered in the consumer goods industry (B2C).

Contents

1. Basics of E-Business and E-Commerce
 - 1.1 Definition of Terms, Limitations and Links to Other Units
 - 1.2 Mobile Commerce
 - 1.1 Trends and Opportunities
 - 1.2 Economic Framework Conditions in E-Commerce
 - 1.3 Value Creation and Business Models
 - 1.4 Actors/Market Participants and Business Relations
2. Forms of E-Commerce
 - 2.1 Types of E-Commerce Operations

- 2.2 Innovative Forms of Interactive E-Commerce
3. Strategic Options in E-Commerce
 - 3.1 Product Range Policy
 - 3.2 Pricing Policy
 - 3.3 Distribution Policy
 - 3.4 Communication Policy
 - 3.5 IT System Landscape and Internal Organization of E-Commerce
 - 3.6 Customer Loyalty, Trust and Reputation
4. Development of an E-Commerce Strategy
 - 4.1 Conceptual Framework
 - 4.2 Target Planning
 - 4.3 E-Business Analysis
 - 4.4 E-Business Strategy Formulation
 - 4.5 E-Business Strategy Implementation and Strategy Audit
5. Success Measurement and Success Factors in E-Commerce
 - 5.1 Success Measurements in E-Commerce
 - 5.2 Success Factors in E-Commerce
6. Opportunities and Risks in E-Commerce
 - 6.1 Legal Risks in E-Commerce (B2C)
 - 6.2 Opportunities and Risks for Pure Players
 - 6.3 Opportunities and Risks for Multi-Channel Players
7. E-Commerce in Selected Sectors
 - 7.1 E-Commerce in the Consumer Goods Sector (B2C) - E-Shop
 - 7.2 E-Commerce in the Capital Goods Sector (B2C) - E-Procurement

Literature

Compulsory Reading

Further Reading

- Turban, E., Whiteside, J., King, D., & Outland, J. (2017). Introduction to electronic commerce and social commerce. Springer.
- Laudon, K., & Traver, C. (2021). E-commerce 2021: Business, technology, and society (16th ed.). Pearson.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

E-Commerce II

Course Code: MWEC02-01_E

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

Course Description

This course expands and deepens the understanding of electronic commerce with elements of operational marketing, especially brand communication and interactive product/service and pricing, complemented by in-depth aspects of the growing importance of payment systems and mobile commerce systems. Based on the understanding of online customer behavior, participants discuss online advertising, pricing and communication, as well as PR activities, for example in the area of social networks. Another focus is on the technical requirements for successful e-commerce, such as usability, selection of shop and payment systems. The course program is supplemented by legal framework conditions and possibilities for customer integration. After completing this course, students will have a deeper understanding of marketing implications of e-commerce.

Course Outcomes

On successful completion, students will be able to

- assess the potential of an online shop to successfully sell products and services over the Internet.
- know the conceptual, technical and legal aspects of e-commerce
- describe important prerequisites for success in e-commerce such as product range presentation, checkout and payment processes, conversion rate, etc.
- know selection criteria for shop systems and know the most important ones (Hybris, Magento etc.)
- explain current and future challenges, so that they can implement e-shop and e-commerce projects themselves.

Contents

1. Basics of Online Marketing and E-Commerce
 - 1.1 Behavior of Online Customers
 - 1.2 Forms of Online Marketing
 - 1.3 Importance, Function and Impact of Online Marketing in E-Commerce
 - 1.4 Online Sales Channels, Mobile Marketing and Apps
 - 1.5 Implementation: Decision Criteria, Specifications and Project Management
2. Web Usability

- 2.1 Criteria of Good Web Usability
- 2.2 Barrier-Free Design and Responsive Design
- 2.3 Search Engine Optimization and Content Marketing
3. Network-Based Payment Systems
 - 3.1 Criteria for Web-Based Payment Systems
 - 3.2 Prepaid Systems, Pay-Now Systems and Pay-Later Systems
 - 3.3 Mobile Payment and Scoring
4. Legal Basis
 - 4.1 Legal Aspects of Ordering and Delivery Processes
 - 4.2 General Terms and Conditions, Commercial Law and Right of Withdrawal
 - 4.3 Image Rights, Trademark Protection and Data Privacy
 - 4.4 Liability of the Shop and Website Operator
5. Shop Systems - Tools - Logistics
 - 5.1 Success Factors and Selection Criteria of a Good Online Shop
 - 5.2 Seal of Approval/Certification
 - 5.3 Range of Goods and Ordering Process
 - 5.4 Processing and Logistics
 - 5.5 Collection and Receivables Management
6. Social Media Marketing in E-Commerce
 - 6.1 Cross-Media Marketing of Online Shops
 - 6.2 Customer Retention and Achievement of Reach
 - 6.3 Conflict Management in Social Networks
 - 6.4 Social Media Advertising and Advertising Networks
7. Monitoring and Analysis
 - 7.1 Measuring Success: Goals, Methods and Funds
 - 7.2 Targeting and KPI Definitions
 - 7.3 Web Controlling
 - 7.4 Visitor Analysis

Literature**Compulsory Reading****Further Reading**

- Wiedenhofer, L. (2021). Digital customer experience engineering: Strategies for creating effective digital experiences. Apress.
- Lesvitt, M. O., & Shneiderman, B. (2007). Research-based web design & usability guidelines. United States Government Printing Office.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Written Assessment: Case Study

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Online Tests <input checked="" type="checkbox"/> Guideline

IT Law for IT Security

Module Code: DLMCSEEITLS_E

Module Type see curriculum	Admission Requirements <ul style="list-style-type: none"> ▪ DLMIGCR01-01_E or DLMIGCR01-01; DLMIMWITR01_E or DLMIMWITR01 ▪ none 	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Dr. Mohammad Shackow (International IT Law) / Dr. Mohammad Shackow (Seminar: Legal Framework for IT-Security)

Contributing Courses to Module

- International IT Law (DLMIMWITR01_E)
- Seminar: Legal Framework for IT-Security (DLMCSEEITLS01_E)

Module Exam Type

Module Exam

Split Exam

International IT Law

- Study Format "Distance Learning": Exam, 90 Minutes

Seminar: Legal Framework for IT-Security

- Study Format "Distance Learning": Written Assessment: Research Essay

Weight of Module

see curriculum

Module Contents**International IT Law**

- Introduction
- E-Business and E-Commerce
- Intellectual Property
- Privacy and Data Protection
- Information Security and Computer Crime
- Online Media and Telecommunication

Seminar: Legal Framework for IT-Security

Compliance with the law is a major driver of security in organizations. The student must understand the various legal frameworks and jurisdictions that may apply to her/his work. Law also plays a role in pursuing criminals that attack an organization. Therefore, the support of preservation of evidence plays a key role. In this module, we explore these legal frameworks and apply them to realistic problems from the field of computer security.

Learning Outcomes**International IT Law**

On successful completion, students will be able to

- identify and explain the differences between national, transnational and international legal systems.
- identify interfaces between general legal concepts and IT-relevant law.
- identify legal requirements for IT contracting and assess their impact on the (electronic) commercialization of IT products or services.
- assess the impact of the European Data Protection Regulation on business processes and make recommendations for implementation.
- identify the legal views of selected transnational institutions and to assess their impact on international IT law.

Seminar: Legal Framework for IT-Security

On successful completion, students will be able to

- understand how laws apply to cyberspace and IT-Security in organizations and enterprises.
- understand the legal limitations of pursuing criminals for law enforcement agencies and the importance of preservation of evidence.
- appreciate the differences in international law as applied to computer operations.
- understand how legal frameworks drive computer security compliance.

Links to other Modules within the Study Program

This module is similar to other modules in the field of Law

Links to other Study Programs of the University

All Master Programs in the Business & Management fields

International IT Law

Course Code: DLMIMWITR01_E

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

Course Description

This course presents in depth national and international legal framework conditions of information processing for companies. After an examination of the differences between international legal systems, an introduction is given to those legal constructs which serve as a basis for the development of IT-relevant legislation. Subsequently, areas of law are discussed from the perspective of concrete application-oriented business scenarios, such as contract law, licensing and patenting. An introduction to the EU legal system is followed by a detailed discussion of the European General Data Protection Regulation (GDPR), which gains increasingly international interest. This leads into a consideration of transnational legal systems and concludes with recommendations from supranational organizations.

Course Outcomes

On successful completion, students will be able to

- identify and explain the differences between national, transnational and international legal systems.
- identify interfaces between general legal concepts and IT-relevant law.
- identify legal requirements for IT contracting and assess their impact on the (electronic) commercialization of IT products or services.
- assess the impact of the European Data Protection Regulation on business processes and make recommendations for implementation.
- identify the legal views of selected transnational institutions and to assess their impact on international IT law.

Contents

1. Introduction
 - 1.1 General Concepts of Law
 - 1.2 Areas of Law
 - 1.3 International, Transnational and EU Law
 - 1.4 Definition and Scope of IT Law
 - 1.5 International, Transnational and European IT Law
 - 1.6 Law in Cross-Border Systems

2. E-Business and E-Commerce
 - 2.1 General Terms and Conditions of Business
 - 2.2 Electronic Commerce
 - 2.3 IT Contracts
 - 2.4 Intermediaries and Platforms
 - 2.5 Antitrust Law and IT
3. Intellectual Property
 - 3.1 Basic Concepts of Intellectual Property
 - 3.2 Copyright
 - 3.3 Software Copyright and Software Licensing
 - 3.4 Free and Open Licensing
 - 3.5 Patenting of Software
4. Privacy and Data Protection
 - 4.1 Basic Concepts of Privacy and Data Protection
 - 4.2 European General Data Protection Regulation (GDPR)
 - 4.3 Implementation Approaches of the GDPR
 - 4.4 International Data Transfer
5. Information Security and Computer Crime
 - 5.1 Information Security Law
 - 5.2 Electronic Signatures and Digital Identities
 - 5.3 Cybercrime
6. Online Media and Telecommunication
 - 6.1 Basics of Online Media Law
 - 6.2 Social Media and Freedom of Expression
 - 6.3 Fundamentals of Telecommunications Law
 - 6.4 Internet and Domain Law

Literature**Compulsory Reading****Further Reading**

- Lloyd, I. (2020): Information Technology Law. Oxford University Press, Oxford.
- Lutzi, T. (2020): Private International Law Online: Internet Regulation and Civil Liability in the EU. Oxford University Press, Oxford.
- Nirmal, B. C. & Singh, R. K. (ed.) (2018): Contemporary Issues in International Law. Environment, International Trade, Information Technology and Legal Education. Springer, Berlin.
- Savin, A. (2017): EU Internet Law. Edward Elgar Publishing.
- Siems, M. (2018): Comparative law. Cambridge University Press, Cambridge.
- Thirlway, H. (2019): The sources of international law. Oxford University Press, Oxford.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Seminar: Legal Framework for IT-Security

Course Code: DLMCSEEITLS01_E

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		5	DLMIGCR01-01_E or DLMIGCR01-01; DLMIMWITR01_E or DLMIMWITR01

Course Description

Computer security does not operate in a legal vacuum. It is subject to legal frameworks in regard of the applicability of international law in cyberspace, National Cyber Security strategies and national policies and legislation. Due to the global nature of Cyberspace, not limited to national boundaries, Organizations often operate in a variety of jurisdictions with a variety of laws. Criminals are using this fact by putting their key operations outside the reach of their victim's jurisdiction. State actors and non-State actors operate in legal grey zones to pursue their targets. Therefore, international organizations, such as the EU, OSCE, ASEAN, are developing compliance frameworks and mechanisms. In this seminar we examine cases and legal frameworks that IT-Security personnel has to recognize.

Course Outcomes

On successful completion, students will be able to

- understand how laws apply to cyberspace and IT-Security in organizations and enterprises.
- understand the legal limitations of pursuing criminals for law enforcement agencies and the importance of preservation of evidence.
- appreciate the differences in international law as applied to computer operations.
- understand how legal frameworks drive computer security compliance.

Contents

- Students will be given an aspect of law or a legal case to study and report on. Of particular importance is to understand what potential consequences the case or law will have on an organization and enterprises. Specific legal text or cases will be provided by the tutor but proposals by the students can be considered.

Literature

Compulsory Reading

Further Reading

- Clarke, R. A. / Knake R. K. (2010): Cyber War. 1st edition, HarperCollins, New York City, NY.
- Lusthaus, J. (2018): Industry of Anonymity. Harvard University Press, Cambridge, MA.
- Schmitt, M. N. (ed.) (2017): Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations. Cambridge University Press, Cambridge.
- Schneier, B. (2015): Data and Goliath. 1st edition, W. W. Norton & Company, New York City, NY.

Study Format Distance Learning

Study Format Distance Learning	Course Type Seminar
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Research Essay

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

Instructional Methods	
Learning Material <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Guideline

AI and Mastering AI Prompting

Module Code: DLMEAIMAIP

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 10	Student Workload 300 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Prof. Dr. Claudia Heß (Artificial Intelligence) / N.N. (Project: AI Excellence with Creative Prompting Techniques)

Contributing Courses to Module

- Artificial Intelligence (DLMAIAI01)
- Project: AI Excellence with Creative Prompting Techniques (DLMPAIECPT01)

Module Exam Type

Module Exam

Split Exam

Artificial Intelligence

- Study Format "Distance Learning": Exam, 90 Minutes
- Study Format "myStudies": Exam, 90 Minutes

Project: AI Excellence with Creative Prompting Techniques

- Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents**Artificial Intelligence**

- History of AI
- Expert Systems
- Neuroscience
- Modern AI Systems
- AI Application Areas

Project: AI Excellence with Creative Prompting Techniques

In this module, students delve into the world of generative AI applications, creating AI-generated content such as text, images, and videos. They learn to design, analyze, and evaluate different prompting techniques in these systems and apply them within their respective fields of study.

Learning Outcomes**Artificial Intelligence**

On successful completion, students will be able to

- remember the historical developments in the field of artificial intelligence.
- analyze the different application areas of artificial intelligence.
- comprehend expert systems.
- apply Prolog to simple expert systems.
- comprehend the brain and cognitive processes from a neuro-scientific point of view.
- understand modern developments in artificial intelligence.

Project: AI Excellence with Creative Prompting Techniques

On successful completion, students will be able to

- comprehend and implement various prompting techniques in generative AI applications.
- analyze, assess, and combine different prompt techniques for various expected AI outputs.
- implement ethical considerations into the design and execution of various generative AI applications.
- design, implement, and refine effective prompts and their combinations for real-world scenarios through various hands-on exercises.
- showcase creative and innovative thinking and reasoning in the application of advanced prompting techniques to solve multidimensional problems in their specialized area of study.

Links to other Modules within the Study Program

This module is similar to other modules in the field of Data Science & Artificial Intelligence

Links to other Study Programs of the University

All Master Programs in the IT & Technology field

Artificial Intelligence

Course Code: DLMAIAI01

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

Course Description

The quest for artificial intelligence 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 the development and use of expert systems in early AI systems. In order to understand cognitive processes, the course will give a brief overview of the biological brain and (human) cognitive processes and then focus on the development of modern AI systems fueled by recent developments in hard- and software. Particular focus will be given to discussion of the development of "narrow AI" systems for specific use cases vs. the creation of general artificial intelligence. The course will give an overview of a wide range of potential application areas in artificial intelligence, including industry sectors such as autonomous driving and mobility, medicine, finance, retail, and manufacturing.

Course Outcomes

On successful completion, students will be able to

- remember the historical developments in the field of artificial intelligence.
- analyze the different application areas of artificial intelligence.
- comprehend expert systems.
- apply Prolog to simple expert systems.
- comprehend the brain and cognitive processes from a neuro-scientific point of view.
- understand modern developments in artificial intelligence.

Contents

1. History of AI
 - 1.1 Historical Developments
 - 1.2 AI Winter
 - 1.3 Notable Advances in AI
2. Expert Systems
 - 2.1 Overview Over Expert Systems
 - 2.2 Introduction to Prolog
3. Neuroscience
 - 3.1 The (Human) Brain

3.2 Cognitive Processes

4. Modern AI Systems

4.1 Recent Developments in Hard- and Software

4.2 Narrow vs General AI

4.3 NLP and Computer Vision

5. AI Application Areas

5.1 Autonomous Vehicles & Mobility

5.2 Personalized Medicine

5.3 FinTech

5.4 Retail & Industry

Literature

Compulsory Reading

Further Reading

- Chowdhary, K. R. (2020). Fundamentals of Artificial Intelligence. Springer India.
- Russell, S. & Norvig, P. (2022). Artificial intelligence. A modern approach (4th ed.). Pearson Education.
- Ward, J. (2020). The student's guide to cognitive neuroscience. (4th ed.). Taylor & Francis Group.

Study Format Distance Learning

Study Format Distance Learning	Course Type Online Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Study Format myStudies

Study Format myStudies	Course Type Lecture
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Information about the examination	
Examination Admission Requirements	Online Tests: yes
Type of Exam	Exam, 90 Minutes

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

Instructional Methods		
Tutorial Support <input checked="" type="checkbox"/> Course Feed	Learning Material <input checked="" type="checkbox"/> Course Book <input checked="" type="checkbox"/> Video <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Slides	Exam Preparation <input checked="" type="checkbox"/> Practice Exam <input checked="" type="checkbox"/> Online Tests

Project: AI Excellence with Creative Prompting Techniques

Course Code: DLMPAIECPT01

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

Course Description

In this course, students explore the exciting world of prompting in various generative AI applications. They involve themselves in hands-on exercises that combine various prompting techniques to create new AI-generated content, including text, images, and videos. Through these exercises, students learn how to effectively use, analyze, combine, and assess these systems within their specialized fields of study.

Course Outcomes

On successful completion, students will be able to

- comprehend and implement various prompting techniques in generative AI applications.
- analyze, assess, and combine different prompt techniques for various expected AI outputs.
- implement ethical considerations into the design and execution of various generative AI applications.
- design, implement, and refine effective prompts and their combinations for real-world scenarios through various hands-on exercises.
- showcase creative and innovative thinking and reasoning in the application of advanced prompting techniques to solve multidimensional problems in their specialized area of study.

Contents

- In this course, students engage in a practical application of a generative AI use case by choosing from the options provided in the extensive supplementary guide. The course presents practical examples as study materials and exercises with both individual and combined prompting techniques for open-source text, image, and video generation use cases. The exercises are crafted to inspire and lead students in executing their distinct generative AI use case work and provide guidance on describing the use case and selecting a mixture of prompting techniques. Additionally, students are led to critically evaluate the design, implementation, and the outcomes 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>
- Epstein, Z., Hertzmann, A., Herman, L., Mahari, R., Frank, M. R., Groh, M., Schroeder, H., Smith, A., Akten, M., Fjeld, J., Farid, H., Leach, N., Pentland, A. S., & Russakovsky, O. (2023). Art and the science of generative AI: A deeper dive. arXiv. <https://arxiv.org/pdf/2306.04141.pdf>
- Gozalo-Brizuela, R., & Garrido-Merchán, E. C. (2023). A survey of generative AI applications. arXiv. <https://arxiv.org/pdf/2306.02781.pdf>
- Wei, J., Wang, X., Schuurmans, D., Bosma, M., Ichter, B., Xia, F., Chi, E. H., Le, Q. V., & Zhou, D. (2023). Chain-of-thought prompting elicit reasoning in large language models. arXiv. <https://arxiv.org/pdf/2201.11903.pdf>

Study Format Distance Learning

Study Format Distance Learning	Course Type Project
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Written Assessment: Project Report

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

Instructional Methods	
Tutorial Support <input checked="" type="checkbox"/> Course Feed <input checked="" type="checkbox"/> Intensive Live Sessions/Learning Sprint	Exam Preparation <input checked="" type="checkbox"/> Guideline

4. Semester

Master Thesis

Module Code: MMTHE

Module Type see curriculum	Admission Requirements none	Study Level MA	CP 30	Student Workload 900 h
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Semester / Term see curriculum	Duration Minimum 1 semester	Regularly offered in WiSe/SoSe	Language of Instruction and Examination English
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Module Coordinator

Degree Program Advisor (SGL) (Master Thesis) / Degree Program Advisor (SGL) (Colloquium)

Contributing Courses to Module

- Master Thesis (MMTHE01)
- Colloquium (MMTHE02)

Module Exam Type

Module Exam

Split Exam

Master Thesis

- Study Format "Distance Learning": Master Thesis (90)
- Study Format "myStudies": Master Thesis (90)

Colloquium

- Study Format "Distance Learning": Colloquium (10)
- Study Format "myStudies": Colloquium (10)

Weight of Module

see curriculum

<p>Module Contents</p> <p>Master Thesis</p> <ul style="list-style-type: none"> ▪ Master's thesis <p>Colloquium</p> <ul style="list-style-type: none"> ▪ Colloquium on the Master's thesis 	
<p>Learning Outcomes</p> <p>Master Thesis</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ work on a problem from their major field of study by applying the specialist and methodological skills they have acquired during their studies. ▪ analyse selected tasks with scientific methods, critically evaluate them and develop appropriate solutions under the guidance of an academic supervisor. ▪ record and analyse existing (research) literature appropriate to the topic of the Master's thesis. ▪ prepare a detailed written elaboration in compliance with scientific methods. <p>Colloquium</p> <p>On successful completion, students will be able to</p> <ul style="list-style-type: none"> ▪ present a problem from their field of study under consideration of academic presentation and communication techniques. ▪ reflect on the scientific and methodological approach chosen in the Master's thesis. ▪ actively answer subject-related questions from subject experts (experts of the Master's thesis). 	
<p>Links to other Modules within the Study Program</p> <p>This module is similar to other modules in the field(s) of Methods.</p>	<p>Links to other Study Programs of the University</p> <p>All Master Programmes in the Business & Management field(s).</p>

Master Thesis

Course Code: MMTHE01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		27	none

Course Description

The aim and purpose of the Master'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 Master's thesis can be a practical-empirical or theoretical-scientific problem. Students should prove that they can independently analyse 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 to be chosen by the student from the respective field of study should not only prove the acquired scientific competences, but should also deepen and round off the academic knowledge of the student in order to optimally align his professional abilities and skills with the needs of the future field of activity.

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.
- analyse selected tasks with scientific methods, critically evaluate them and develop appropriate solutions under the guidance of an academic supervisor.
- record and analyse existing (research) literature appropriate to the topic of the Master's thesis.
- prepare a detailed written elaboration in compliance with scientific methods.

Contents

- Within the framework of the Master'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 his 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**

- Bui, Y. N. (2013). *How to Write a Master's Thesis* (2nd ed.). SAGE Publications, Incorporated.
- Turabian, K. L. (2013). *A Manual for Writers of Research Papers, theses, and dissertations* (8th ed.). University of Chicago Press.
- Further subject specific literature

Study Format Distance Learning

Study Format Distance Learning	Course Type Thesis
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Master Thesis

Student Workload					
Self Study 810 h	Contact Hours 0 h	Tutorial/Tutorial Support 0 h	Self Test 0 h	Independent Study 0 h	Hours Total 810 h

Instructional Methods

Study Format myStudies

Study Format myStudies	Course Type Thesis
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Master Thesis

Student Workload					
Self Study 810 h	Contact Hours 0 h	Tutorial/Tutorial Support 0 h	Self Test 0 h	Independent Study 0 h	Hours Total 810 h

Instructional Methods

Colloquium

Course Code: MMTHE02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
MA	English		3	none

Course Description

The colloquium will take place after submission of the Master's thesis. This is done at the invitation of the experts. During the colloquium, the students must prove that they have fully 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, and the answering of questions by the experts.

Course Outcomes

On successful completion, students will be able to

- present a problem from their field of study under consideration of academic presentation and communication techniques.
- reflect on the scientific and methodological approach chosen in the Master's thesis.
- actively answer subject-related questions from subject experts (experts of the Master's thesis).

Contents

- The colloquium includes a presentation of the most important results of the Master's thesis, followed by the student answering the reviewers' technical questions.

Literature

Compulsory Reading

Further Reading

- Renz, K.-C. (2016): The 1 x 1 of the presentation. For school, study and work. 2nd edition, Springer Gabler, Wiesbaden.

Study Format Distance Learning

Study Format Distance Learning	Course Type Thesis Defense
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Colloquium

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

Instructional Methods
Learning Material <input checked="" type="checkbox"/> Slides

Study Format myStudies

Study Format myStudies	Course Type Thesis Defense
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Information about the examination	
Examination Admission Requirements	Online Tests: no
Type of Exam	Colloquium

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

Instructional Methods
Learning Material <input checked="" type="checkbox"/> Slides