MODULE HANDBOOK

Bachelor of Science

Bachelor Data Science (FI-BADSC)

180 ECTS

Distance Learining

INTERNATIONAL
UNIVERSITY OF
APPLIED SCIENCES

Classification: Undergraduate

Contents

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3. Semester

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4. Semester

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5. Semester

2020-02-01

1. Semester

Introduction to Data Science

Module Code: DLBDSIDS

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

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

Module Coordinator

Prof. Dr. Thomas Zöller (Introduction to Data Science)

Contributing Courses to Module

- Introduction to Data Science (DLBDSIDS01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Oral Assignment	

Weight of Module

see curriculum

Module Contents

- Introduction to data science
- Data
- Data science in business
- Statistics
- Machine learning

Learning Outcomes

Introduction to Data Science

On successful completion, students will be able to

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

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

Introduction to Data Science

Course Code: DLBDSIDS01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

3. Data Science in Business
   - 3.1 Identification of use cases
   - 3.2 Performance evaluation
   - 3.3 Data-driven operational decisions
   - 3.4 Cognitive biases

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

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

Literature

Compulsory Reading

Further Reading

- Dorard, L. (2014): Bootstrapping machine learning. The first guide to prediction APIs. CreateSpace Independent Publishing Platform, Scotts Valley, CA.
- Downey, A. B. (2013): Think Bayes. O'Reilly, Sebastopol, CA.
- Downey, A. B. (2014): Think stats. 2nd ed., O'Reilly, Sebastopol, CA.
- Kahneman, D. (2012): Thinking, fast and slow. Penguin, London.
- Muller, A. C./Guido, S. (2016): Introduction to machine learning with Python. O'Reilly, Sebastopol, CA.
- Olson, J. (2003): Data quality - The accuracy dimension. Morgan Kaufmann, San Francisco, CA.
- Patil, D. J./Mason, H. (2015): Data driven. O'Reilly Media, Sebastopol, CA.
- VanderPlas, J. (2017): Python data science handbook. O'Reilly, Sebastopol, CA.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Oral Assignment

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

DLBDSIDS01

Introduction to Academic Work

Module Code: DLBCSIAW

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

Semester / Term	Duration	Regularly offered in	
s. Curriculum/see curriculum	Minimum 1 semester	WiSe/SoSe	

Module Coordinator

Prof. Dr. Maya Stagge (Introduction to Academic Work)

Contributing Courses to Module

- Introduction to Academic Work (DLBCSIAW01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Workbook	

Weight of Module

s. Curriculum/see curriculum

Module Contents

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

Learning Outcomes

Introduction to Academic Work

Nach erfolgreichem Abschluss sind die Studierenden in der Lage,/On successful completion, students will be able to

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

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

Introduction to Academic Work

Course Code: DLBCSIAW01

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

Course Description

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

Course Outcomes

Nach erfolgreichem Abschluss sind die Studierenden in der Lage,/On successful completion, students will be able to

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

Contents

1. Theory of Science
   - 1.1 Introduction to Science and Research
   - 1.2 Research Paradigms
   - 1.3 Fundamental Research Decisions
   - 1.4 Effects of Scientific Paradigms on Research Design

2. Application of Good Scientific Practice
   - 2.1 Research Ethics
   - 2.2 Evidence Teaching
   - 2.3 Data Protection and Affidavit
   - 2.4 Orthography and Shape
   - 2.5 Identification and Delimitation of Topics
   - 2.6 Research Questions and Structure

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

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

5. Scientific Work at the IUBH – Research Essay

6. Scientific Work at the IUBH - Project Report

7. Scientific Work at the IUBH - Case Study

8. Scientific Work at the IUBH - Bachelor Thesis

9. Scientific Work at the IUBH – Oral Assignment

10. Scientific Work at the IUBH – Oral Project Report

11. Scientific Work at the IUBH - Colloquium

12. Scientific Work at the IUBH - Portfolio

13. Scientific Work at the IUBH - Exam

Literature
Compulsory Reading
Further Reading ▪ Bortz, J./Döring, N. (2012): Forschungsmethoden und Evaluation. Für Human- und Sozialwissenschaftler. 5. Auflage, Springer Medizin Verlag, Heidelberg. ▪ Braunecker, C. (2016): How to do Empirie, how to do SPSS – eine Gebrauchsanleitung. Facultas Verlags- und Buchhandels AG, Wien. ▪ Engelen, E.M. et al. (2010): Heureka – Evidenzkriterien in den Wissenschaften, ein Kompendium für den interdisziplinären Gebrauch. Spektrum akademischer Verlag, Heidelberg. ▪ Flick, U. et al. (2012): Handbuch Qualitative Sozialforschung. Grundlagen, Konzepte, Methoden und Anwendungen. 3. Auflage, Beltz Verlag, Weinheim. ▪ Hug, T./Poscheschnik, G. (2015): Empirisch Forschen, 2. Auflage, Verlag Huter & Roth KG, Wien. ▪ Hussy, W. et al. (2013): Forschungsmethoden in Psychologie und Sozialwissenschaften. 2. Auflage, Springer Medizin Verlag, Heidelberg.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Workbook

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

Introduction to Programming with Python

Module Code: DLBDSIPWP

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

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

Module Coordinator

Dr. Reza Shahbazfar (Introduction to Programming with Python)

Contributing Courses to Module

- Introduction to Programming with Python (DLBDSIPWP01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Introduction to Programming with Python

On successful completion, students will be able to

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

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the field(s) of Data Science & Artificial Intelligence.	All Bachelor Programmes in the IT & Technology field(s).

Introduction to Programming with Python

Course Code: DLBDSIPWP01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

3. Statements
   - 3.1 Assignment, expressions, and print
   - 3.2 Conditional statements
   - 3.3 Loops
   - 3.4 Iterators and comprehensions

4. Functions
   - 4.1 Function declaration
   - 4.2 Scope
   - 4.3 Arguments

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

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

Literature

Compulsory Reading

Further Reading

- Barry, P. (2016): Head first Python: A brain-friendly guide. 2nd ed., O'Reilly, Sebastopol, CA.
- Lubanovic, B. (2019): Introducing Python. 2nd ed., O'Reilly, Sebastopol, CA.
- Lutz, M. (2013): Learning Python. 5th ed., O'Reilly, Sebastopol, CA.
- Matthes, E. (2019): Python crash course: A hands-on, project-based introduction to programming. 2nd ed., No Starch Press, San Francisco, CA.
- Ramalho, L. (2015): Fluent Python: Clear, concise, and effective programming. O'Reilly, Sebastopol, CA.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Mathematics: Analysis

Module Code: DLBDSMFC

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

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

Module Coordinator

Prof. Dr. Timo Heinisch (Mathematics: Analysis)

Contributing Courses to Module

- Mathematics: Analysis (DLBDSMFC01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Sequences and series
- Functions & reverse functions
- differential calculus
- integral calculus

Learning Outcomes

Mathematics: Analysis

On successful completion, students will be able to

- summarize the basic concepts of analysis.
- illustrate the terms "consequences" and "series".
- explain the concept of function and to understand the concept of the inverse function.
- explain basic statements of the differential and integral calculus.
- explain the relationship between differentiation and integration.
- master the derivation of higher-dimensional functions.

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

Mathematics: Analysis

Course Code: DLBDSMFC01

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

Course Description

Analysis is one of the essential basic subjects of mathematics. Originally developed to be able to formulate and solve problems of classical mechanics mathematically, in its present rigorous form it has become indispensable in numerous applications in the natural sciences and technology. This module aims to introduce the basic hand tool of differential and integral calculus and to explain their mutual interrelations. In addition, the differential calculus is generalized to multidimensional spaces.

Course Outcomes

On successful completion, students will be able to

- summarize the basic concepts of analysis.
- illustrate the terms "consequences" and "series".
- explain the concept of function and to understand the concept of the inverse function.
- explain basic statements of the differential and integral calculus.
- explain the relationship between differentiation and integration.
- master the derivation of higher-dimensional functions.

Contents

1. Sequences and series
   - 1.1 Sequences and series
   - 1.2 Convergence of infinite series
   - 1.3 power series
2. Functions and reverse functions
   - 2.1 Continuous functions
   - 2.2 Exponential and logarithm function
   - 2.3 Trigonometric functions and their inverse functions
3. Differential calculus
   - 3.1 Derivatives and higher derivatives
   - 3.2 curve discussion
   - 3.3 Rules (chain rule, product rule, quotient rule ...)
   - 3.4 Taylor Rows

4. Integral calculus
   - 4.1 The Riemann Integral
   - 4.2 Specific and indefinite integrals
   - 4.3 The fundamental theorem of differential and integral calculus
   - 4.4 Volumes and shells of rotary bodies
   - 4.5 Paths and lengths

5. Differential calculus in the Rn
   - 5.1 Partial Derivation
   - 5.2 Total Derivation
   - 5.3 Gradients of vector-valued functions and matrices

Literature

Compulsory Reading

Further Reading

- Arens, T. et al. (2013): Basic knowledge of mathematics studies. Analysis and Linear Algebra with Cross Connections. Springer, Berlin/Heidelberg.
- Boas, M. L. (2006): Mathematical methods in the physical sciences. Third edition. Wiley. Hoboken, NJ.
- Deisenroth, M. P./Faisal, A./Ong C.-S.: Math for ML. Cambridge University Press.
- Heuser, H. (2009): Textbook of Analysis. Vieweg + Teubner (studies). Wiesbaden.
- Modler, F./Kreh, M. (2014): Tutorial Analysis 1 and Linear Algebra 1. Mathematics explained and commented by students for students. 3rd edition, Springer Spektrum, Berlin/Heidelberg.
- Papula, L. (2014): Mathematics for engineers and scientists. Vol. 1: A textbook and workbook for basic studies. Springer Vieweg, Wiesbaden.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☑ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSMFC01

Collaborative Work

Module Code: DLBCSCW

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

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

Module Coordinator

Prof. Dr. Karin Halbritter (Collaborative Work)

Contributing Courses to Module

- Collaborative Work (DLBCSCW01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Oral Assignment	

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Collaborative Work

On successful completion, students will be able to

- design their own self-directed and collaborative learning processes with analog and digital media.
- initiate local and virtual cooperation and select suitable methods for shaping cooperation.
- assess different forms of communication in relation to the goals and requirements of different situations and reflect one's own communication and argumentation behaviour.
- explain potentials for conflict and the role of emotions in conflicts and describe the use of systemic methods in the target- and solution-oriented handling of conflicts.
- form an idea of one's own resources, present methods of self-management and self-motivation, and derive appropriate strategies.

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

Collaborative Work

Course Code: DLBCSCW01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

- design their own self-directed and collaborative learning processes with analog and digital media.
- initiate local and virtual cooperation and select suitable methods for shaping cooperation.
- assess different forms of communication in relation to the goals and requirements of different situations and reflect one's own communication and argumentation behaviour.
- explain potentials for conflict and the role of emotions in conflicts and describe the use of systemic methods in the target- and solution-oriented handling of conflicts.
- form an idea of one's own resources, present methods of self-management and self-motivation, and derive appropriate strategies.

Contents

1. Learning for a Networked World in a Networked World
   - 1.1 Requirements and Opportunities of the VUCA World
   - 1.2 Learning, Information, and Dealing with Knowledge and Ignorance
   - 1.3 C-Model: Collective – Collaborative – Continuous – Connected
   - 1.4 Checking Your Own Learning Behaviour
2. Networking and Cooperation
   - 2.1 Finding and Winning Suitable Cooperation Partners
   - 2.2 Sustainable Relationships: Digital Interaction and Building Trust
   - 2.3 Collaboration: Organizing Locally and Virtually and Using Media
   - 2.4 Social Learning: Agile, Collaborative, and Mobile Planning of Learning Processes

3. Performance in (Virtual) Teams
   - 3.1 Goals, Roles, Organization and Performance Measurement
   - 3.2 Team Building and Team Flow
   - 3.3 Scrum as a Framework for Agile Project Management
   - 3.4 Design Thinking, Kanban, Planning Poker, Working-in-Progress-Limits & Co

4. Communicate and Convince
   - 4.1 Communication as Social Interaction
   - 4.2 Language, Images, Metaphors, and Stories
   - 4.3 It's the Attitude that Counts: Open, Empathetic, and Appreciative Communication
   - 4.4 Listen Actively - Argue - Convince - Motivate
   - 4.5 Analyze Your Own Conversational and Argumentational Skills

5. Recognize Conflict Potentials - Handle Conflicts - Negotiate Effectively
   - 5.1 Respecting Diversity - Seizing Opportunities
   - 5.2 Developing Empathy for Yourself and Others
   - 5.3 Systemic Work Solutions and Reframing
   - 5.4 Negotiate Constructively: Finding Clear Words - Interests Instead of Positions

6. Realize Your Own Projects
   - 6.1 Set Goals Effectively - Focus - Reflect
   - 6.2 The Agile Use of One's Own Time
   - 6.3 (Self-)Coaching and Inner Team
   - 6.4 Strategies and Methods for Self-Management and Self-Motivation

7. Mobilize Your Resources
   - 7.1 Recognizing Resources - Regulating Emotions
   - 7.2 Reflection and Innovation - Lateral Thinking and Creativity
   - 7.3 Transfer Strength and Willpower: Analyzing and Controlling Condition Factors

8. Construction Kit: Overview of Concepts, Tools, and Methods
   - 8.1 Communicate, Cooperate, Negotiate, Argue
   - 8.2 Think, Reflect, Develop Ideas, Decide, Lead Yourself

Literature
Compulsory Reading
Further Reading ▪ Baber, A. (2015): Strategic connections. The new face of networking in a collaborative world. Amacom, New York. ▪ Goleman, D. (2013): Focus. The hidden driver of excellence. Harper Collins USA, New York. ▪ Kaats, E./Opheij, W. (2014): Creating conditions for promising collaboration. Alliances, networks, chains, strategic partnerships. Springer Management, Berlin. ▪ Lang, M. D. (2019): The guide to reflective practice in conflict resolution. Rowman & Littlefield, Lanham/Maryland. ▪ Martin, S. J./Goldstein, N. J./Cialdini, R. B. (2015): The small BIG. Small changes that spark BIG influence. Profile Books, London.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Oral Assignment

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

Statistics: Probability and Descriptive Statistics

Module Code: DLBDSSPDS

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

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

Module Coordinator

Dr. Stefan Stöckl (Statistics: Probability and Descriptive Statistics)

Contributing Courses to Module

- Statistics: Probability and Descriptive Statistics (DLBDSSPDS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Probability
- Random variables
- Joint distributions
- Expectation and variance
- Inequalities and limit theorems

Learning Outcomes

Statistics: Probability and Descriptive Statistics

On successful completion, students will be able to

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

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

Statistics: Probability and Descriptive Statistics

Course Code: DLBDSSPDS01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Bruce, P., & Bruce, A. (2017). Practical statistics for data scientists: 50 essential concepts. Sebastopol, CA: O'Reilley.
- Downey, A. B. (2014). Think stats (2nd ed.). Sebastopol, CA: O'Reilly.
- Downey, A. B. (2013). Think Bayes. Sebastopol, CA: O'Reilly.
- Reinhart, A. (2015). Statistics done wrong: The woefully complete guide. San Francisco, CA: No Starch Press.
- Wassermann, L. (2004). All of statistics: A concise course in statistical inference. New York, NY: Springer Science+Business Media.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☑ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSSPDS01

2. Semester

Object Oriented and Functional Programming with Python

Module Code: DLBDSOOFPP

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

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

Module Coordinator

Prof. Dr. Max Pumperla (Object oriented and functional programming in Python)

Contributing Courses to Module

- Object oriented and functional programming in Python (DLBDSOOFPP01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Object oriented and functional programming in Python

On successful completion, students will be able to

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

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

Object oriented and functional programming in Python

Course Code: DLBDSOOFPP01

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

Course Description

This course builds upon basic knowledge of Python programming (Introduction to Programming with Python, DLBDSIPWP) and is concerned with the exposition of advanced Python programming concepts. To this end, important notions of object-oriented programming like classes and objects and pertaining design principles are outlined. Starting from an in-depth discussion of advanced features of Python functions, functional programming concepts and their implementation in Python are conveyed.

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSOOFPP01

Mathematics: Linear Algebra

Module Code: DLBDSMFLA

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

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

Module Coordinator

Prof. Dr. Moustafa Nawito (Mathematics: Linear Algebra)

Contributing Courses to Module

- Mathematics: Linear Algebra (DLBDSMFLA01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Matrix algebra
- Vector spaces
- Linear and affine transformations
- Analytical geometry
- Matrix decomposition

Learning Outcomes

Mathematics: Linear Algebra

On successful completion, students will be able to

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

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

Mathematics: Linear Algebra

Course Code: DLBDSMFLA01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Fundamentals
   - 1.1 Systems of linear equations
   - 1.2 Matrices as compact representations of linear equations
   - 1.3 Matrix algebra
   - 1.4 Inverse and trace
2. Vector Spaces
   - 2.1 Definition
   - 2.2 Linear combination and linear dependance
   - 2.3 Base, span, and rank
3. Linear and affine mappings
   - 3.1 Matrix representations of linear mappings
   - 3.2 Image and kernel
   - 3.3 Affine spaces and sub-spaces
   - 3.4 Affine mappings

4. Analytical Geometry
   - 4.1 Norms
   - 4.2 Inner and dot product
   - 4.3 Orthogonal projections
   - 4.4 Rotations

5. Matrix Decomposition
   - 5.1 Determinant and trace
   - 5.2 Eigenvalues and eigenvectors
   - 5.3 Cholesky decomposition
   - 5.4 Eigenvalue decomposition and diagonalisation
   - 5.5 Singular value decomposition

Literature

Compulsory Reading

Further Reading

- Arfken, G./Weber, H. J./Harris, F. E. (2012): Mathematical methods for physicists. 7th ed., Academic Press, Cambridge, MA.
- Boas, M. L. (2006): Mathematical methods in the physical sciences. 3rd ed.,Wiley, Hoboken, NJ.
- Deisenroth, M. P./Faisal, A./Ong C. S. (2019): Math for machine learning. (URL: https://mml-book.com).
- Riley, K. F./Hobson, M. P./Bence, S. J. (2006): Mathematical methods for physics and engineering. Cambridge University Press, Cambridge.
- Strang, G. (2016): Introduction to linear algebra, 5th ed., Wellesley-Cambridge Press, Wellesley, MA.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☑ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSMFLA01

Intercultural and Ethical Decision-Making

Module Code: DLBCSIDM

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

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

Module Coordinator

Prof. Dr. Jürgen Matthias Seeler (Intercultural and Ethical Decision-Making)

Contributing Courses to Module

- Intercultural and Ethical Decision-Making (DLBCSIDM01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Intercultural and Ethical Decision-Making

On successful completion, students will be able to

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

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

Intercultural and Ethical Decision-Making

Course Code: DLBCSIDM01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Emrich, C. (2011): Interkulturelles Management: Erfolgsfaktoren im globalen Business. Kohlhammer-Verlag, Stuttgart/Berlin/Köln.
- Erll, A./Gymnich, M. (2015): Uni-Wissen Interkulturelle Kompetenzen: Erfolgreich kommunizieren zwischen den Kulturen – Kernkompetenzen. 4. Auflage, Klett Lerntraining, Stuttgart.
- Eß, O. (2010): Das Andere lehren: Handbuch zur Lehre Interkultureller Handlungskompetenz. Waxmann Verlag, Münster.
- Hofstede, G./ Hofstede, G. J./Minkov, M. (2017): Lokales Denken, globales Handeln Interkulturelle Zusammenarbeit und globales Management. 6. Auflage, Beck, München.
- Leenen, W.R./Groß, A. (2018): Handbuch Methoden Interkultureller Bildung und Weiterbildung. Verlag Vandenhoeck & Ruprecht, Göttingen.
- Thomas, A. (2011): Interkulturelle Handlungskompetenz. Versiert, angemessen und erfolgreich im internationalen Geschäft. Gabler-Verlag, Wiesbaden.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Case Study

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Written Assessment: Case Study

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

Statistics - Inferential Statistics

Module Code: DLBDSSIS

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSSPDS01	BA	5	150 h

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

Module Coordinator

Dr. Stefan Stöckl (Statistics - Inferential Statistics)

Contributing Courses to Module

- Statistics - Inferential Statistics (DLBDSSIS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Point estimation
- Uncertainties
- Bayesian inference & non-parametric techniques
- Statistical testing
- Statistical decision theory

Learning Outcomes

Statistics - Inferential Statistics

On successful completion, students will be able to

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

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

Statistics - Inferential Statistics

Course Code: DLBDSSIS01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSSPDS01

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Bruce, P., & Bruce, A. (2017). Practical statistics for data scientists: 50 essential concepts. Sebastopol, CA: O'Reilley.
- Downey, A. B. (2013). Think Bayes. Sebastopol, CA: O'Reilly.
- Downey, A. B. (2014). Think stats (2nd ed.). Sebastopol, CA: O'Reilly.
- Reinhart, A. (2015). Statistics done wrong: The woefully complete guide. San Francisco, CA: No Starch Press.
- Wassermann, L. (2004). All of statistics: A concise course in statistical inference. Cham: Springer.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☑ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSSIS01

Database Modeling and Database Systems

Module Code: DLBCSDMDS

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

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

Module Coordinator

Prof. Dr. Ralf Kneuper (Database Modeling and Database Systems)

Contributing Courses to Module

- Database Modeling and Database Systems (DLBCSDMDS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Fundamentals of relational databases
- Simple database queries
- Entity/Relationship (E/R) Diagrams
- database development
- Complex database queries across multiple tables
- Changing data in databases
- NoSQL database systems

Learning Outcomes

Database Modeling and Database Systems

On successful completion, students will be able to

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

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

Database Modeling and Database Systems

Course Code: DLBCSDMDS01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Edlich, S./Friedland, A./Hampe, J./Brauer, B./Brückner, M. (2011): NoSQL. Einstieg in die Welt nichtrelationaler Web 2.0 Datenbanken. 2. Auflage, Hanser, München.
- Throll, M/Bartosch, O. (2010): Einstieg in SQL. Verstehen, einsetzen, nachschlagen. 4. Auflage, Galileo Computing, Bonn.
- Steiner, R. (2017): Grundkurs Relationale Datenbanken. Einführung in die Praxis der Datenbankentwicklung für Ausbildung, Studium und IT-Beruf. 9. Auflage, Springer Vieweg, Wiesbaden.
- Unterstein, M./Matthiessen, G. (2013): Anwendungsentwicklung mit Datenbanken. 5. Auflage, Springer Vieweg, Wiesbaden.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBCSDMDS01

Project: Build a Data Mart in SQL

Module Code: DLBDSPBDM

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

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

Module Coordinator

Sharam Dadashnia (Project: Build a Data Mart in SQL)

Contributing Courses to Module

- Project: Build a Data Mart in SQL (DLBDSPBDM01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Portfolio	

Weight of Module

see curriculum

Module Contents

- This course is about the implementation of a practical database use case employing previously-acquired knowledge on pertaining approaches and methods.

Learning Outcomes

Project: Build a Data Mart in SQL

On successful completion, students will be able to

- transfer previously-acquired knowledge about database methods and approaches to practical use cases.
- design, architect, and implement a working data-mart solution.
- reason about design choices of and trade-offs between relevant implementation alternatives.
- critically evaluate said choices with respect to the stated design goal.
- describe and explain the resulting solution.

Links to other Modules within the Study Program	Links to other Study Programs of IUBH
This module is similar to other modules in the field(s) of Data Science & Artificial Intelligence.	All Bachelor Programmes in the It & Technology field(s).

Project: Build a Data Mart in SQL

Course Code: DLBDSPBDM01

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

Course Description

This course provides the opportunity to implement a realistic database use case scenario. A list of use case ideas is provided on the online learning platform. In addition, the students can contribute use case ideas of their own in accord with the tutor. The core aim is to apply the hitherto theoretical knowledge of database methods and approaches to solve a real-world application scenario. This entails reasoning about possible design and architectural choices in a rational way, as well as implementing them in a functioning database system.

Course Outcomes

On successful completion, students will be able to

- transfer previously-acquired knowledge about database methods and approaches to practical use cases.
- design, architect, and implement a working data-mart solution.
- reason about design choices of and trade-offs between relevant implementation alternatives.
- critically evaluate said choices with respect to the stated design goal.
- describe and explain the resulting solution.

Contents

- In this course, students apply their knowledge of data modeling and databases to implement a project use case of their choosing. All relevant artefacts, like use case evaluation, chosen implementation method, code, and outcomes, are documented in the form of a written project report.

Literature
Compulsory Reading
Further Reading ▪ Date, C. J. (2012). Database design and relational theory. Sebastopol, CA: O'Reilly. ▪ DeBarros, A. (2018). Practical SQL: A beginner's guide to storytelling with data. San Francisco, CA: No Starch Press. ▪ Harrington, J. L. (2016). Relational database design and implementation (4th ed.). Burlington, MA: Morgan Kaufmann. ▪ Hernandez, M. J. (2013). Database design for mere mortals: A hands-on guide to relational database design (3rd ed.). Boston, MA: Addison-Wesley. ▪ Viescas, J. (2018). SQL queries for mere mortals: A hands-on guide to data manipulation in SQL (4th ed.). Boston, MA: Addison-Wesley.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** yes
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSPBDM01

3. Semester

Business Intelligence

Module Code: DLBCSEBI1

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

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

Module Coordinator

Prof. Dr. Sebastian Werning (Business Intelligence)

Contributing Courses to Module

- Business Intelligence (DLBCSEBI01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Business Intelligence

On successful completion, students will be able to

- explain the motivation, use cases, and basics of Business Intelligence.
- identify and explain techniques and methods for providing and modeling data, as well as types of data relevant to BI, differentiating between them.
- explain techniques and methods for the generation and storage of information and independently select suitable methods on the basis of concrete requirements.

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

Business Intelligence

Course Code: DLBCSEBI01

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

Course Description

Business Intelligence (BI) is used to obtain information from company data that is relevant for targeted corporate management and the optimization of business activities. This course introduces and discusses techniques, procedures, and models for data provision, information generation, and analysis, as well the distribution of the information obtained. You will then be able to explain the various subject areas of data warehousing and independently select methods and techniques to meet specific requirements.

Course Outcomes

On successful completion, students will be able to

- explain the motivation, use cases, and basics of Business Intelligence.
- identify and explain techniques and methods for providing and modeling data, as well as types of data relevant to BI, differentiating between them.
- explain techniques and methods for the generation and storage of information and independently select suitable methods on the basis of concrete requirements.

Contents

1. Motivation and Conceptualization
   - 1.1 Motivation and Historical Development
   - 1.2 BI as a Framework
2. Data Provision
   - 2.1 Operative and Dispositive Systems
   - 2.2 The Data Warehouse Concept
   - 2.3 Architectural Variations
3. Data Warehouse
   - 3.1 ETL Process
   - 3.2 DWH and Data Mart
   - 3.3 ODS and Metadata

4. Modelling of Multidimensional Data Spaces
   - 4.1 Data Modeling
   - 4.2 OLAP Cubes
   - 4.3 Physical Storage
   - 4.4 Star and Snowflake Scheme
   - 4.5 Historicization

5. Analysis Systems
   - 5.1 Free Data Research and OLAP
   - 5.2 Reporting Systems
   - 5.3 Model-Based Analysis Systems
   - 5.4 Concept-Oriented Systems

6. Distribution and Access
   - 6.1 Information Distribution
   - 6.2 Information Access

Literature

Compulsory Reading

Further Reading

- Bachmann, R./Kemper, G. (2011): Raus aus der BI-Falle. Wie Business Intelligence zum Erfolg wird. 2. Auflage, mitp, Heidelberg.
- Bauer, A./Günzel, H. (2008): Data Warehouse Systeme. Architektur, Entwicklung, Anwendung. 3. Auflage, dpunkt.verlag, Heidelberg.
- Betz, R. (2015): Werde Jäger des verlorenen Schatzes. In: Immobilienwirtschaft, Heft 5, S. 1614–1164. (URL https://www.haufe.de/download/immobilienwirtschaft-ausgabe-052015-immobilienwirtschaft-fachmagazin-fuer-management-recht-praxis-303530.pdf [letzter Zugriff: 27.02.2017]).
- Bodendorf, F. (2006): Daten- und Wissensmanagement. 2. Auflage, Springer, Berlin.
- Chamoni, P./Gluchowski, P. (Hrsg.) (2006): Analytische Informationssysteme Business Intelligence-Technologien und -Anwendungen. Springer, Berlin.
- Engels, C. (2008): Basiswissen Business Intelligence. W3L, Herdecke/Witten.
- Gansor, T./Totok, A./Stock, S. (2010): Von der Strategie zum Business Intelligence Competency Center (BICC). Konzeption – Betrieb – Praxis. Hanser, München.
- Gluchowski, P./Gabriel, R./Dittmar, C. (2008): Management Support Systeme und Business Intelligence. Computergestützte Informationssysteme für Fach- und Führungskräfte. 2. Auflage, Springer, Berlin/Heidelberg.
- Grothe, M. (2000): Business Intelligence. Aus Informationen Wettbewerbsvorteile gewinnen. Addison-Wesley, München.
- Gutenberg, E. (1983): Grundlagen der Betriebswirtschaft, Band 1. Die Produktion. 18. Auflage, Springer, Berlin/Heidelberg/New York.
- Hannig, U. (Hrsg.) (2002): Knowledge Management und Business Intelligence. Springer, Berlin.
- Hansen, H.-R./Neumann, G. (2001): Wirtschaftsinformatik I. Grundlagen betrieblicher Informationsverarbeitung. 8. Auflage, Lucius & Lucius UTB, Stuttgart.
- Humm, B./Wietek, F. (2005): Architektur von Data Warehouses und Business Intelligence Systemen. In: Informatik Spektrum, S. 3–14. (URL: https://www.fbi.h-da.de/fileadmin/personal/b.humm/Publikationen/Humm__Wietek_-_Architektur_DW__Informatik-Spektrum_2005-01_.pdf [letzter Zugriff: 27.02.2017]).
- Kemper, H.-G./Baars, H./Mehanna, W. (2010): Business Intelligence – Grundlagen und praktische Anwendungen. Eine Einführung in die IT-basierte Managementunterstützung. 3. Auflage, Vieweg+Teubner, Stuttgart.
- Turban, E. et al. (2010): Business Intelligence. A Managerial Approach. 2. Auflage, Prentice Hall, Upper Saddle River (NJ).

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Business Intelligence

Module Code: DLBCSEBI2

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	5	149 h

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

Module Coordinator

Prof. Dr. Sebastian Werning (Project: Business Intelligence)

Contributing Courses to Module

- Project: Business Intelligence (DLBCSEBI02)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

Possible topics for the BI project include “Management of BI projects”, “Design of multidimensional data models” and “Prototypical implementation of small BI applications”.

Learning Outcomes

Project: Business Intelligence

On successful completion, students will be able to

- independently design a solution to a practical problem in the field of Business Intelligence in order to then implement a prototype and document the results.
- identify and explain typical problems and challenges in the design and practical implementation of small BI solutions.

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

Project: Business Intelligence

Course Code: DLBCSEBI02

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

Course Description

Using well-known methods and techniques from the field of Business Intelligence, students will work independently on a practical question in this course.At the end of the course you will be able to independently design and prototype Business Intelligence applications based on concrete requirements.

Course Outcomes

On successful completion, students will be able to

- independently design a solution to a practical problem in the field of Business Intelligence in order to then implement a prototype and document the results.
- identify and explain typical problems and challenges in the design and practical implementation of small BI solutions.

Contents

- Implementation and documentation of practical questions regarding the use of Business Intelligence applications. Typical scenarios are, for example, “Management of BI projects”, “Design of multidimensional data models” and “Prototypical implementation of small BI applications”.

Literature

Compulsory Reading

Further Reading

- Brenner, W./Uebernickel, F. (2015): Design Thinking. Das Handbuch. Frankfurter Allgemeine Buch, Frankfurt a. M.
- Brown, T. (2008): Design Thinking. In: Harvard Business Review, Heft Juni, S. 84–95.
- Meinel, C./Weinberg, U./Krohn, T. (Hrsg.) (2015): Design Thinking Live. Wie man Ideen entwickelt und Probleme löst. Murmann, Hamburg.
- Uebernickel, F./Brenner, W. (2016): Design Thinking. In: Hoffmann, C. P. et al. (Hrsg.): Business Innovation: Das St. Galler Modell. Springer, Wiesbaden, S. 243–265.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☐ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

Machine Learning - Supervised Learning

Module Code: DLBDSMLSL

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSMFC01, DLBDSMFLA01, DLBDSSPDS01, DLBDSSIS01	BA	5	150 h

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

Module Coordinator

Prof. Dr. Christian Müller-Kett (Machine Learning - Supervised Learning)

Contributing Courses to Module

- Machine Learning - Supervised Learning (DLBDSMLSL01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Types of machine learning
- Classification
- Regression
- Support vector machines
- Decision trees

Learning Outcomes

Machine Learning - Supervised Learning

On successful completion, students will be able to

- remember central notions and paradigms of machine learning.
- describe the key ideas of regression and pertaining regularization methods.
- know basic classification techniques.
- explain tree structured machine learning models.
- understand support vector machines and the related kernel approach.

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

Machine Learning - Supervised Learning

Course Code: DLBDSMLSL01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSMFC01, DLBDSMFLA01, DLBDSSPDS01, DLBDSSIS01

Course Description

This course provides a first introduction to the field of machine learning with a focus on supervised learning (i.e., learning from labeled data), where the most commonly used models in regression and classification are being introduced. Moreover, the course provides an introduction to the concepts of large margin classifiers and tree structured models.

Course Outcomes

On successful completion, students will be able to

- remember central notions and paradigms of machine learning.
- describe the key ideas of regression and pertaining regularization methods.
- know basic classification techniques.
- explain tree structured machine learning models.
- understand support vector machines and the related kernel approach.

Contents

1. Introduction to Machine Learning
   - 1.1 Pattern recognition systems
   - 1.2 The machine learning design cycle
   - 1.3 Technical notions of learning and adaptation
   - 1.4 Under- and overfitting
2. Regression
   - 2.1 Linear regression
   - 2.2 Lasso- and ridge Regularization
   - 2.3 Generalized linear models
   - 2.4 Logistic regression
3. Basic Classification Techniques
   - 3.1 K-nearest neighbour
   - 3.2 Naive Bayes

4. Support Vector Machines
   - 4.1 Large margin classification
   - 4.2 The kernel trick

5. Decision & Regression Trees
   - 5.1 Decision & regression trees
   - 5.2 Random forest
   - 5.3 Gradient boosting

Literature

Compulsory Reading

Further Reading

- Bishop, C. M. (2011). Pattern recognition and machine learning. New York, NY: Springer.
- Grus, J. (2019). Data science from scratch: First principles with Python (2nd ed.). Sebastopol, CA: O'Reilly.
- Muller, A. C., & Guido, S. (2016). Introduction to machine learning with Python. Sebastopol, CA: O'Reilly.
- Ozdemir, S., & Susarla, D. (2018). Feature engineering made easy: Identify unique features from your dataset in order to build powerful machine learning systems. Birmingham: Packt Publishing.
- VanderPlas, J. (2017). Python data science handbook. Sebastopol, CA: O'Reilly Publishing.
- Webb, A. R., & Copsey, K. D. (2011). Statistical pattern recognition (3rd ed.). Hoboken, NJ: Wiley.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSMLSL01

Machine Learning - Unsupervised Learning and Feature Engineering

Module Code: DLBDSMLUSL

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSMFC01, DLBDSMFLA01, DLBDSSPDS01, DLBDSSIS01	BA	5	150 h

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

Module Coordinator

Prof. Dr. Christian Müller-Kett (Machine Learning - Unsupervised Learning and Feature Engineering)

Contributing Courses to Module

- Machine Learning - Unsupervised Learning and Feature Engineering (DLBDSMLUSL01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Unsupervised machine learning
- Clustering
- Dimensionality reduction
- Manifold learning
- Feature engineering
- Feature selection
- Automation of feature generation and selection

Learning Outcomes

Machine Learning - Unsupervised Learning and Feature Engineering

On successful completion, students will be able to

- explain the notions of unsupervised learning and feature selection.
- recall commonly-applied clustering models.
- understand the concept and utility of dimensionality reduction and manifold learning.
- describe effective approaches to feature engineering.
- discuss the methods of automatic feature generation and selection.

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

Machine Learning - Unsupervised Learning and Feature Engineering

Course Code: DLBDSMLUSL01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSMFC01, DLBDSMFLA01, DLBDSSPDS01, DLBDSSIS01

Course Description

This course is concerned with the tools and techniques for unsupervised learning and feature engineering. Unsupervised learning denotes machine learning approaches that can be applied without label information. As such, the aim is to extract patterns or statistical regularities in data, and finding good features is key for the successful application of machine learning models. Therefore, having a solid set of approaches and tools for this task is of crucial importance for any data scientist. This course introduces the most relevant methods and shows how unsupervised learning techniques can be utilized to find robust and meaningful features.

Course Outcomes

On successful completion, students will be able to

- explain the notions of unsupervised learning and feature selection.
- recall commonly-applied clustering models.
- understand the concept and utility of dimensionality reduction and manifold learning.
- describe effective approaches to feature engineering.
- discuss the methods of automatic feature generation and selection.

Contents

1. Introduction to Unsupervised Machine Learning and Feature Engineering
   - 1.1 Unsupervised machine learning
   - 1.2 Feature engineering
2. Clustering
   - 2.1 K-Means
   - 2.2 Gaussian mixture model clustering
   - 2.3 Hierarchical clustering

3. Dimensionality Reduction
   - 3.1 Principal component analysis
   - 3.2 Multi-dimensional scaling
   - 3.3 Locally linear embedding

4. Feature Engineering
   - 4.1 Numerical features
   - 4.2 Categorial features
   - 4.3 Text features

5. Feature Selection
   - 5.1 Feature importance
   - 5.2 Feature variance
   - 5.3 Correlation matrix
   - 5.4 Recursive feature selection

6. Automated Feature Generation
   - 6.1 Automated feature generation
   - 6.2 Feature engineering versus deep learning

Literature

Compulsory Reading

Further Reading

- Bishop, C. M. (2011). Pattern recognition and machine learning. New York, NY: Springer.
- Grus, J. (2019). Data science from scratch: First principles with Python (2nd ed.). Sebastopol, CA: O'Reilly.
- Muller, A. C., & Guido, S. (2016). Introduction to machine learning with Python. Sebastopol, CA: O'Reilly.
- Ozdemir, S., & Susarla, D. (2018). Feature engineering made easy: Identify unique features from your dataset in order to build powerful machine learning systems. Birmingham: Packt Publishing.
- VanderPlas, J. (2017). Python data science handbook. Sebastopol, CA: O'Reilly Publishing.
- Webb, A. R., & Copsey, K. D. (2011). Statistical pattern recognition (3rd ed.). Hoboken, NJ: Wiley.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Case Study

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Written Assessment: Case Study

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

DLBDSMLUSL01

Data Science Software Engineering

Module Code: DLBDSDSSE

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSIPWP01 or DLBDSIPWP01_D; DLBDSOOFPP01 or IOBP01	BA	5	150 h

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

Module Coordinator

Prof. Dr. Max Pumperla (Data Science Software Engineering)

Contributing Courses to Module

- Data Science Software Engineering (DLBDSDSSE01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Traditional project management
- Agile project management
- Testing
- Software development paradigms
- From model to production

Learning Outcomes

Data Science Software Engineering

On successful completion, students will be able to

- understand the concept of project management approaches.
- apply agile approaches in software development.
- create automated software tests.
- understand various software development paradigms.
- evaluate the necessary steps to bring models into a production environment.

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

Data Science Software Engineering

Course Code: DLBDSDSSE01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSIPWP01 or DLBDSIPWP01_D; DLBDSOOFPP01 or IOBP01

Course Description

A core part of data science is creating value from data. This means not only the creation of sophisticated predictive models but also the development of these models according to modern software development principles.This course gives a detailed overview of the relevant methods and paradigms which data scientists need to know in order to develop enterprise-grade models.This course discusses traditional and agile project management techniques, highlighting both the Kanban and Scrum approaches. It explores relevant software development paradigms such as test-driven development, pair programming, mob programming, and extreme programming.Special focus is given to the topic of testing and the consideration of how to bring a model into a production environment.

Course Outcomes

On successful completion, students will be able to

- understand the concept of project management approaches.
- apply agile approaches in software development.
- create automated software tests.
- understand various software development paradigms.
- evaluate the necessary steps to bring models into a production environment.

Contents

1. Traditional Project Management
   - 1.1 Requirements engineering
   - 1.2 Waterfall model
   - 1.3 Rational unified process
2. Agile Project Management
   - 2.1 Criticism of the waterfall model
   - 2.2 Introduction to SCRUM
   - 2.3 Introduction to Kanban

3. Testing
   - 3.1 Why testing?
   - 3.2 Unit trests
   - 3.3 Integration tests
   - 3.4 Performance monitoring

4. Software Development Paradigms
   - 4.1 Test-driven development (TDD)
   - 4.2 Pair programming
   - 4.3 Mob programming
   - 4.4 Extreme programming

5. From Model to Production
   - 5.1 Continuous delivery
   - 5.2 Continuous integration
   - 5.3 Building a scalable environment

Literature

Compulsory Reading

Further Reading

- Farcic, V. (2016): The DevOps 2.0 toolkit: Automating the continuous deployment pipeline with containerized microservices. CreateSpace Independent Publishing Platform, Scotts Valley, CA.
- Humble, J./Farley, D. (2010): Continuous delivery: Reliable software releases through build, test, and deployment automation. Addison-Wesley Professional, Boston, MA.
- Humble, J./Molesky, J./O'Reilly, B. (2015): Lean enterprise. O'Reilley Publishing, Sebastopol, CA.
- Hunt, A./Thomas, D. (1999): The pragmatic programmer. From journeyman to master. Addison-Wesley, Reading, MA.
- Martin, R. C. (2008): Clean code. Prentice Hall, Boston, MA.
- Morris, K. (2016): Infrastructure as code. O'Reilley Publishing, Sebastopol, CA.
- Richardson, L./Ruby, S. (2007): RESTful web services. O'Reilley Publishing, Sebastopol, CA.
- Senge, P. (1990): The fifth discipline: The art and practice of the learning organization. Broadway Business, New York, NY.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSDSSE01

Project: From Model to Production

Module Code: DLBDSMTP

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSDSSE01, DLBDSIPWP01, DLBDSOOFPP01	BA	5	150 h

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

Module Coordinator

Prof. Dr. Christian Müller-Kett (Project: From Model to Production)

Contributing Courses to Module

- Project: From Model to Production (DLBDSMTP01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

This course focuses on creating a setup which allows the integration of a predictive model into an enterprise-grade application or service.

Learning Outcomes

Project: From Model to Production

On successful completion, students will be able to

- understand the challenges of integrating a predictive model into an application or service.
- evaluate the constraints a project imposes on the execution of a predictive model.
- analyze the requirements regarding data acquisition, storage, and processing.
- identify the necessary monitoring components required for reliable execution of the predictive model.
- create and design a production environment for storing, accessing, and serving the predictive model.

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

Project: From Model to Production

Course Code: DLBDSMTP01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSDSSE01, DLBDSIPWP01, DLBDSOOFPP01

Course Description

This project course will give students hands-on experience in the challenging task of bringing a predictive model into a production environment. Students will need to consider practical aspects such as data storage and processing, as well as constraints such as service availability and the maximum amount of time a model is allowed to run due to external project requirements.Through this course, students will obtain holistic overview of the integration of predictive models into enterprise-grade applications or services.

Course Outcomes

On successful completion, students will be able to

- understand the challenges of integrating a predictive model into an application or service.
- evaluate the constraints a project imposes on the execution of a predictive model.
- analyze the requirements regarding data acquisition, storage, and processing.
- identify the necessary monitoring components required for reliable execution of the predictive model.
- create and design a production environment for storing, accessing, and serving the predictive model.

Contents

- This project course focuses on practical aspects of ensuring that a predictive model can run in a production environment. The students start with a chosen use case and model and then evaluate the requirements which need to be fulfilled so that the model can be used as part of an enterprise application or app. Students need to evaluate requirements in terms of data storage, processing and throughput, and availability of the service, as well as the persistency, serving, and versioning of the model itself. Monitoring the execution of model predictions and raising alerts in cases of operational issues is a core part of building a reliable model pipeline. All relevant artifacts and considerations are documented by the students in a project report.

Literature
Compulsory Reading
Further Reading ▪ Geron, A. (2017). Hands-on machine learning with Scikit-Learn and TensorFlow. Sebastopol, CA: O'Reilly Publishing. ▪ Karau, H., Konwinski, A., Wendell, A., & Zaharia, M. (2015). Learning spark: Lightning-fast data analysis. Sebastopol, CA: O'Reilly Publishing. ▪ Kleppmann, M. (2017). Designing data-intensive Aapplications: The big ideas behind reliable, scalable, and maintainable systems. Sebastopol, CA: O'Reilly Publishing. ▪ Kuhn, M., & Johnson, K. (2013). Applied predictive modeling. New York, NY: Springer. ▪ Maydanchik, A. (2007). Data quality assessment. Denville, NJ: Technics Publications. ▪ Müller, A., & Guido, S. (2016). Introduction to machine learning with Python: A guide for data scientists. Boston, MA: O'Reilly. ▪ Narkhede, N., Shapira, G., & Palino, T. (2017). Kafka: The definitive guide: Real-time data and stream processing at scale. Sebastopol, CA: O'Reilly Publishing. ▪ Psaltis, A. (2017). Streaming data: Understanding the real-time pipeline. Shelter Island, NY: Manning Publications. ▪ White, T. (2015). Hadoop: The definitive guide: Storage and analysis at Internet scale. Sebastopol, CA: O'Reilly Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Oral Project Report

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSMTP01

4. Semester

Agile Project Management

Module Code: DLBCSAPM

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

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

Module Coordinator

Dr. Mark Menzel (Agile Project Management)

Contributing Courses to Module

- Agile Project Management (DLBCSAPM01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- In this course, students are taught action competences in the field of agile project management. They will be familiarized with the values, activities, roles, and artifacts of agile procedures using Scrum as an example.

Learning Outcomes

Agile Project Management

On successful completion, students will be able to

- explain the differences between agile and plan-driven project management.
- explain agile principles.
- work together in an agile manner according to the values defined in Scrum.
- apply the activities defined in Scrum.
- take responsibility for the roles defined in Scrum.
- create and maintain the artefacts defined in Scrum.

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

Agile Project Management

Course Code: DLBCSAPM01

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

Course Description

Students will receive a practical introduction to agile project management in this course. In addition to teaching its individual basic principles, the differences between agile project management and plan-driven project management will be examined in detail. In order to understand and experience agile project management, the values, activities, roles, and artefacts of typical agile procedures are presented using Scrum and then practiced on an example project.

Course Outcomes

On successful completion, students will be able to

- explain the differences between agile and plan-driven project management.
- explain agile principles.
- work together in an agile manner according to the values defined in Scrum.
- apply the activities defined in Scrum.
- take responsibility for the roles defined in Scrum.
- create and maintain the artefacts defined in Scrum.

Contents

- This course teaches students various skills in the field of agile project management. In contrast to plan-driven project management, the principles of agility used in modern software development are taught. Using the example of Scrum, students will acquire skills in applying an agile approach, and then apply their knowledge of respective roles and activities in a simple project to gain initial practical experience, documenting it in a project report. The content of the projects results from the individual abilities and requirements of the students.

Literature
Compulsory Reading
Further Reading ▪ Röpstorff, S./Wiechmann, R. (2012): Scrum in der Praxis. Erfahrungen, Problemfelder und Erfolgsfaktoren. dpunkt.verlag, Heidelberg. ▪ Rubin, K. S. (2014): Essential Scrum. Umfassendes Scrum-Wissen aus der Praxis. Mitp Verlag, Frechen. ▪ Roock, A. (2011): Software-Kanban. Eine Einführung. In: Projektmagazin, Heft 4, ▪ Leffingwell, D. et al. (o. J.): Scaled Agile Framework. (URL: http://scaledagileframework.com/ [letzter Zugriff: 17.07.2015]). ▪ Schwaber, K./Sutherland, J. (o. J.): The Scrum Guide - The definitive Guide to Scrum: The Rules of the Game. www.scrumguides.org

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☐ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

Big Data Technologies

Module Code: DLBDSBDT

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBCSDMDS01	BA	5	150 h

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

Module Coordinator

Prof. Dr. Christian Müller-Kett (Big Data Technologies)

Contributing Courses to Module

- Big Data Technologies (DLBDSBDT01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Data types and data sources
- Text-based and binary data formats
- Distributed systems
- Streaming frameworks
- NoSQL approach to data storage

Learning Outcomes

Big Data Technologies

On successful completion, students will be able to

- name types and sources of data.
- understand text-based and binary data formats.
- analyze the requirements and constraints of distributed analysis systems.
- evaluate the applications of streaming frameworks.
- describe the motivation for NoSQL data stores and categorize pertaining established concepts.

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

Big Data Technologies

Course Code: DLBDSBDT01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBCSDMDS01

Course Description

Data are often considered the “new oil”, the raw material from which value is created. To harness the power of data, the data need to be stored and processed on a technical level. This course introduces the four “Vs” of data, as well as typical data sources and types. The course discusses the most common data storage formats encountered in modern systems, focusing both on text-based as well as binary data formats.Handling large amounts of data poses significant challenges for the underlying infrastructure. The course discusses the most important distributed and streaming data handling frameworks which are used in leading edge applications.

Course Outcomes

On successful completion, students will be able to

- name types and sources of data.
- understand text-based and binary data formats.
- analyze the requirements and constraints of distributed analysis systems.
- evaluate the applications of streaming frameworks.
- describe the motivation for NoSQL data stores and categorize pertaining established concepts.

Contents

1. Data Types and Data Sources
   - 1.1 The 4Vs of data: volume, velocity, variety, veracity
   - 1.2 Data sources
   - 1.3 Data types
2. Text-Based and Binary Data Formats
   - 2.1 Simple formats: CSV, YAML
   - 2.2 XML
   - 2.3 JSON
   - 2.4 Hierarchical data format 5 (HDF 5)
   - 2.5 Apache Parquet
   - 2.6 Apache Arrow

3. NoSQL data stores
   - 3.1 Introduction and motivation
   - 3.2 Approaches and technical concepts

4. Distributed Systems
   - 4.1 Hadoop & MapReduce
   - 4.2 Hadoop file system (HDFS)
   - 4.3 Spark
   - 4.4 DASK

5. Streaming Frameworks
   - 5.1 Spark streaming
   - 5.2 Kafka

Literature

Compulsory Reading

Further Reading

- Karau, H., Konwinski, A., Wendell, A., & Zaharia, M. (2015). Learning spark: Lightning-fast data analysis. Sebastopol, CA: O'Reilly.
- Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. Sebastopol, CA: O'Reilly.
- Narkhede, N., Shapira, G., & Palino, T. (2017). Kafka: The definitive guide: Real-time data and stream processing at scale. Sebastopol, CA: O'Reilly.
- Psaltis, A. (2017). Streaming data: Understanding the real-time pipeline. Shelter Island, NY: Manning.
- White, T. (2015). Hadoop: The definitive guide: Storage and analysis at Internet scale. Sebastopol, CA: O'Reilly.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSBDT01

Data Quality and Data Wrangling

Module Code: DLBDSDQDW

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSIPWP01, DLBDSOOFPP01	BA	5	150 h

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

Module Coordinator

N.N. (Data Quality and Data Wrangling)

Contributing Courses to Module

- Data Quality and Data Wrangling (DLBDSDQDW01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Data quality and associated management techniques
- Data acquisition from public sources
- Working with relevant data formats
- Techniques for shaping and tidying data for analysis

Learning Outcomes

Data Quality and Data Wrangling

On successful completion, students will be able to

- discuss the fundamental aspects of data quality.
- describe common approaches to data quality management.
- use various methods to gather data from websites and other public data sources.
- work with established data formats.
- explain widely-used techniques for data preparation.

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

Data Quality and Data Wrangling

Course Code: DLBDSDQDW01

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

Course Description

The goal of data science can be summarized as the extraction of insights (hence, value) from data. It is self-evident that this objective cannot be successfully achieved based on unreliable and untrustworthy data. This course aims at establishing the notion of data quality and the pertinent methods for data quality management. Furthermore, techniques for acquiring data as well as formatting and tidying data in order to make it suitable for subsequent analytical treatment are covered.

Course Outcomes

On successful completion, students will be able to

- discuss the fundamental aspects of data quality.
- describe common approaches to data quality management.
- use various methods to gather data from websites and other public data sources.
- work with established data formats.
- explain widely-used techniques for data preparation.

Contents

1. Data Quality
   - 1.1 Introduction to data quality
   - 1.2 Data quality dimensions and issue types
2. Data Quality Management
   - 2.1 Data governance and stewardship
   - 2.2 Activities and processes
3. Data Acquisition
   - 3.1 Web scraping
   - 3.2 Data APIs
4. Working with Common Data Formats
   - 4.1 Text-based formats (CSV, XML, JSON)
   - 4.2 Binary formats (HDF 5, Parquet, Arrow)

5. Tidy Data
   - 5.1 Structuring
   - 5.2 Cleansing
   - 5.3 Enrichment

Literature

Compulsory Reading

Further Reading

- Carreras, C., Kandel, S., Heer, J., Rattenbury, T., & Hellerstein, J. M. (2017). Principles of data wrangling. Sebastopol, CA: O'Reilly Media.
- Fürber, C. (2016). Data quality management with semantic technologies. Wiesbaden: Springer Gabler.
- Loshin, D. (2010). The practitioner's guide to data quality improvement. Burlington, MA: Morgan Kaufmann.
- Roychowdhury, S., & Sarkar, T. (2019). Data wrangling with Python. Birmingham: Packt Publishing.
- Visochek, A. (2017). Practical data wrangling. Birmingham: Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Written Assessment: Written Assignment

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

DLBDSDQDW01

Explorative Data Analysis and Visualization

Module Code: DLBDSEDAV

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSIPWP01, DLBDSOOFPP01	BA	5	150 h

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

Module Coordinator

N.N. (Explorative Data Analysis and Visualization)

Contributing Courses to Module

- Explorative Data Analysis and Visualization (DLBDSEDAV01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Explorative Data Analysis and Visualization

On successful completion, students will be able to

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

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

Explorative Data Analysis and Visualization

Course Code: DLBDSEDAV01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

3. Data Visualization Practice
   - 3.1 Amounts, proportions, associations, and distributions
   - 3.2 Time series and trends
   - 3.3 Geo-spatial data

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

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

Literature

Compulsory Reading

Further Reading

- Anderson, C. (2015). Creating a data-driven organization. Sebastopol, CA: O'Reilly Media.
- Bruce, A., & Bruce, P. (2017). Practical statistics for data scientists. Sebastopol, CA: O'Reilly Media.
- Grobmann, T., & Dobler, M. (2019). Data visualization with Python. Birmingham: Packt Publishing.
- Nussbaumer Knaflic, C. (2015). Storytelling with data: A data visualization guide for business professionals. Chichester: John Wiley & Sons.
- VanderPlas, J. (2016). Python data science handbook. Sebastopol, CA: O'Reilly Media.
- Wilke, C. O. (2019). Fundamentals of data visualization. Sebastopol, CA: O'Reilly Media.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Written Assessment: Written Assignment

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

DLBDSEDAV01

Cloud Computing

Module Code: DLBDSCC

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

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

Module Coordinator

Prof. Dr. Thomas Zöller (Cloud Computing)

Contributing Courses to Module

- Cloud Computing (DLBDSCC01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Cloud Computing

On successful completion, students will be able to

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

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

Cloud Computing

Course Code: DLBDSCC01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

4. Established Cloud Platforms
   - 4.1 Google Cloud Platform
   - 4.2 Amazon Web Services
   - 4.3 Microsoft Azure

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

Literature

Compulsory Reading

Further Reading

- Chapin, J., & Roberts, M. (2017). What is serverless? Sebastopol, CA: O'Reilly Media.
- Goessling, S., & Jackson, K. L. (2018). Architecting cloud computing solutions. Birmingham: Packt Publishing.
- Kavis, M. J. (2014). Architecting the cloud: Design decisions for cloud computing service models (SaaS, PaaS, and IaaS). Hoboken, NJ: Wiley.
- Mahmood, Z., Puttini, R., & Erl, T. (2013). Cloud computing: Concepts, technology & architecture. Boston, MA: Prentice Hall.
- Rafaels, R. (2018). Cloud computing (2nd ed.). Scotts Valley, CA: CreateSpace Independent Publishing Platform.
- Sehgal, N. K., & Bhatt, P. C. P. (2018). Cloud computing: Concepts and practices. Cham: Springer.
- Zonooz, P. Farr, E., Arora, K., & Laszewski, T. (2018). Cloud native architectures. Birmingham: Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Seminar: Ethical Considerations in Data Science

Module Code: DLBDSSECDS

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

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

Module Coordinator

N.N. (Seminar: Ethical Considerations in Data Science)

Contributing Courses to Module

- Seminar: Ethical Considerations in Data Science (DLBDSSECDS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

This course aims at creating an awareness of the ethical implications of data science techniques and methodologies. To this end, students will be given the opportunity to acquaint themselves with current literature on the topic and explore the pertinent lines of thinking.

Learning Outcomes

Seminar: Ethical Considerations in Data Science

On successful completion, students will be able to

- contemplate ethical considerations in the field of data science.
- descibe how the application of data science methodology may have adverse ethical effects.
- reason about the ethical impacts of data science, both on a personal level and for society at large.
- explain how existing biases and inequalities could be amplified by technology.
- treat in a scientific manner a selected topic in the form of a written essay.

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

Seminar: Ethical Considerations in Data Science

Course Code: DLBDSSECDS01

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

Course Description

Online trade, social media, media delivery, mass consumption, customer relationship management, hiring decisions, and more: There are hardly any aspects of contemporary life that are not affected by the application of data science methodologies and techniques. Thus, it is of central importance to gain an awareness of these implications and a thorough understanding of the ethical issues in question in order to be an informed practitioner in this field.

Course Outcomes

On successful completion, students will be able to

- contemplate ethical considerations in the field of data science.
- descibe how the application of data science methodology may have adverse ethical effects.
- reason about the ethical impacts of data science, both on a personal level and for society at large.
- explain how existing biases and inequalities could be amplified by technology.
- treat in a scientific manner a selected topic in the form of a written essay.

Contents

- This seminar covers ethical implications of the use of data science methods and techniques. Each participant is expected to write a paper on an assigned topic.

Literature

Compulsory Reading

Further Reading

- Grus, J. (2019). Data science from scratch (2nd ed.). Sebastopol, CA: O'Reilly Media.
- Muller, J. Z. (2019). Tyranny of metrics. Princeton, NJ: Princeton University Press. (Original work published 2018).
- O'Neil, C. (2017). Weapons of math destruction: How big data increases inequality and threatens democracy.). Portland, OR: Broadway Books. (Original work published 2016).
- Patil, D. J., Mason, H., & Loukides, M. (2018). Ethics and data science. Sebastopol, CA: O'Reilly Media.
- Wachter-Boettcher, S. (2018). Technically wrong: Sexist apps, biased algorithms, and other threats of toxic tech. New York, NY: W. W. Norton & Co.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Seminar

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Research Essay

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☐ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSSECDS01

5. Semester

Time Series Analysis

Module Code: DLBDSTSA

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSSPDS01, DLBDSSIS01	BA	5	150 h

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

Module Coordinator

Prof. Dr. Christian Müller-Kett (Time Series Analysis)

Contributing Courses to Module

- Time Series Analysis (DLBDSTSA01)

Module Exam Type

Module Exam	Split Exam
Study Format: Fernstudium Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

- Introduction to time series analysis
- Time series components
- Simple models
- ARMA models
- Holt-Winters models
- Advanced topics

Learning Outcomes

Time Series Analysis

On successful completion, students will be able to

- identify the fundamental concepts of time series analysis.
- cite the components of time series.
- create simple time series models.
- analyze time series data with ARMA and Holt-Winter models.
- understand advanced topics in time series analysis.

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

Time Series Analysis

Course Code: DLBDSTSA01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSSPDS01, DLBDSSIS01

Course Description

Many types of data describe patterns of events which occur sequentially and show dependencies on previous events, e.g., the number of guests in a hospitality service or the number of products sold in a retail outlet. These data show a particular temporal structure which can include additional effects such as seasonality or dependencies on external events.This course focuses on understanding time series data. After a general introduction to the elements of time series analysis, this course discusses ARMA-based models (Box-Jenkins approach) and the alternative Holt-Winters formalism, both of which are used for time series analysis and forecasting.This course also includes a discussion about advanced topics in time series analysis such as the handling of multiple seasonalities and framing a problem statement in the context of supervised learning.

Course Outcomes

On successful completion, students will be able to

- identify the fundamental concepts of time series analysis.
- cite the components of time series.
- create simple time series models.
- analyze time series data with ARMA and Holt-Winter models.
- understand advanced topics in time series analysis.

Contents

1. Introduction to Time-Series Analysis
   - 1.1 What are time series?
   - 1.2 Auto-correlation & partial auto-correlation
   - 1.3 Lag
2. Time-Series Components
   - 2.1 Trend
   - 2.2 Seasonality
   - 2.3 Residuals

3. Simple Models
   - 3.1 Simple average
   - 3.2 Moving average
   - 3.3 Weighted moving average

4. ARMA Models
   - 4.1 Box-Jenkins formalism
   - 4.2 Handling non-stationary models: ARIMA
   - 4.3 Seasonal ARIMA models: SARIMA
   - 4.4 Seasonal models with external variables: SARIMAX

5. Holt-Winters Models
   - 5.1 Simple exponential smoothing
   - 5.2 Dealing with trends: double exponential smoothing
   - 5.3 Dealing with seasonality: triple exponential smoothing

6. Advanced topics
   - 6.1 Multiple seasonalities
   - 6.2 Time series forecasting as a supervised learning problem

Literature

Compulsory Reading

Further Reading

- Bisgaard, S., & Kulahci, M. (2011). Time series analysis and forecasting by example . Hoboken, NJ: Wiley.
- Diebold, F. (2019). Forecasting . University of Pennsylvania. Available online http://www.ssc.upenn.edu/~fdiebold/Textbooks.html
- Diebold, F. (2019). Time Series Econometrics . University of Pennsylvania. Available online http://www.ssc.upenn.edu/~fdiebold/Textbooks.html
- Hyndman, R. J., & Athanasopoulos, G. (2018). Forecasting: Principles and practice (2nd ed.). Melbourne: OTexts. Available online https://otexts.com/fpp2/
- Makridakis, S., Wheelwright, S. C., & Hyndman, R. J. (1998). Forecasting: Methods and applications (3rd ed.). Hoboken, NJ: Wiley.
- Shumway, R., & Stoffer, S. (2017). Time series analysis and its applications . Cham: Springer.

Study Format Fernstudium

Study Format	Course Type
Fernstudium	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Neural Nets and Deep Learning

Module Code: DLBDSNNDL

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSMLSL01, DLBDSMLUSL01	BA	5	150 h

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

Module Coordinator

N.N. (Neural Nets and Deep Learning)

Contributing Courses to Module

- Neural Nets and Deep Learning (DLBDSNNDL01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Oral Assignment	

Weight of Module

see curriculum

Module Contents

- Introduction to neural networks
- Feed-forward networks
- Avoiding overtraining
- Convolutional neural networks
- Recurrent neural networks

Learning Outcomes

Neural Nets and Deep Learning

On successful completion, students will be able to

- understand the fundamental building blocks of neural networks.
- identify different network training approaches.
- create feed-forward neural networks.
- analyze network training and how to avoid overtraining.
- apply advanced network concepts to create convolutional and recurrent neural networks.

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

Neural Nets and Deep Learning

Course Code: DLBDSNNDL01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSMLSL01, DLBDSMLUSL01

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 discusses in detail how feed-forward networks are set up and trained. Special focus is given on how to avoid overtraining in neural networks.In addition to feed-forward neural networks, this course covers additional common network architectures such as convolutional and recurrent neural networks.

Course Outcomes

On successful completion, students will be able to

- understand the fundamental building blocks of neural networks.
- identify different network training approaches.
- create feed-forward neural networks.
- analyze network training and how to avoid overtraining.
- apply advanced network concepts to create convolutional and recurrent neural networks.

Contents

1. Introduction to Neural Networks
   - 1.1 The biological brain
   - 1.2 Building blocks of neural networks
   - 1.3 Deep versus shallow networks
   - 1.4 Supervised learning
   - 1.5 Reinforcement learning
2. Feed-forward Networks
   - 2.1 Architecture and weight initialization
   - 2.2 Cost functions
   - 2.3 Backpropagation and gradient descent
   - 2.4 Batch normalization

3. Overtraining Avoidance
   - 3.1 What is overtraining?
   - 3.2 Early stopping
   - 3.3 L1 and L2 regularization
   - 3.4 Dropout
   - 3.5 Weight pruning

4. Convolutional Neural Networks
   - 4.1 Motivation and applications
   - 4.2 Convolution and image filtering
   - 4.3 CNN architecture
   - 4.4 Popular convolutional networks

5. Recurrent Neural Networks
   - 5.1 Recurrent neurons
   - 5.2 Memory cells
   - 5.3 LSTMs
   - 5.4 Training RNNs: Unrolling through time

Literature

Compulsory Reading

Further Reading

- Chollet, F. (2017). Deep learning with Python . Shelter Island, NY: Manning.
- Efron, B., & Hastie, T. (2016). Computer age statistical inference . Cambridge: Cambridge University Press.
- Geron, A. (2017). Hands-on machine learning with Scikit-Learn and TensorFlow . Sebastopol, CA: O'Reilly Publishing.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning . Boston, MA: MIT Press.
- Grus, J. (2019). Data science from scratch: First principles with Python. Sebastopol, CA: O'Reilley Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Oral Assignment

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

DLBDSNNDL01

Data Engineer

Module Code: DLBDSEDE

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

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

Module Coordinator

N.N. (Data Engineering) / N.N. (Project: Data Engineering)

Contributing Courses to Module

- Data Engineering (DLBDSEDE01)
- Project: Data Engineering (DLBDSEDE02)

Module Exam Type

Module Exam	Split Exam
	Data Engineering • Study Format "Distance Learning": Exam, 90 Minutes Project: Data Engineering • Study Format "Distance Learning": Portfolio

Weight of Module

see curriculum

Module Contents

Data Engineering

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Project: Data Engineering

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Learning Outcomes

Data Engineering

On successful completion, students will be able to

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Project: Data Engineering

On successful completion, students will be able to

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the field(s) of Data Science & Artificial Intelligence.	All Bachelor Programmes in the IT & Technology field(s).

Data Engineering

Course Code: DLBDSEDE01

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

Course Description

This course explores concepts of data engineering. Data engineering is concerned with the infrastructure aspects of data science such as data storage and provision, as well as the provisioning of suitable operational environments.After laying out foundational notions and concepts of the discipline, this course addresses important developments in storage technology; aspects of systems architecture for processing data at scale; containerization as a modern take on virtualization; and the logic of data pipelines and associated operational aspects. Important issues pertaining to data security and protection are also given appropriate attention.

Course Outcomes

On successful completion, students will be able to

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Contents

1. Foundations of Data Engineering
   - 1.1 Reliability
   - 1.2 Scalability
   - 1.3 Maintainability
2. NoSQL In Depth
   - 2.1 Fundamentals of NoSQL
   - 2.2 Established NoSQL solutions
3. Architectures for Data Processing at Scale
   - 3.1 Batch processing architectures
   - 3.2 Architectures for stream and complex event processing
   - 3.3 Lambda architecture

4. Containerization In Depth
   - 4.1 Docker containers
   - 4.2 Container management

5. Governance & Security
   - 5.1 Data protection
   - 5.2 Data security
   - 5.3 Data governance

6. Operational Aspects
   - 6.1 Defining principles of DataOps
   - 6.2 Building and maintaining data pipelines
   - 6.3 Metrics and monitoring

Literature

Compulsory Reading

Further Reading

- Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. Sebastopol, CA: O'Reilly.
- Marz, N., & Warren, J. (2015). Big data: Principles and best practices of scalable realtime data systems. Shelter Island, NY: Manning Publications.
- Matthias, K., & Kane, S. P. (2018). Docker: Up & running (2nd ed.). Sebastopol, CA: O'Reilly.
- Miell, I., & Sayers, A. (2019). Docker in practice (2nd ed.). Shelter Island, NY: Manning Publications.
- Muhammad, S., & Akhtar, F. (2018). Big data architect's handbook. Birmingham: Packt Publishing.
- Schenker, G. N. (2018). Learn Docker - Fundamentals of Docker 18.x: Get up and running with the concepts of Docker. Birmingham: Packt Publishing.
- Wilson, J., Redmond, E., & Perkins, L. (2018). Seven databases in seven weeks (2nd ed.). Raleigh, NC: Pragmatic Bookshelf.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Data Engineering

Course Code: DLBDSEDE02

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

Course Description

The focus of this course is the implementation of a real-world data engineering use case in the form of a student portfolio. To this end, students choose a project subject from the various sub-domains of data engineering. Examples include setting up a Docker container environment or dockerized service; implementing a data pipeline according to DataOps principles; and setting up an NoSQL data store.The goal is for students to demonstrate they can transfer theoretical knowledge to an implementation scenario that closely mimics practical work in a professional data engineering setting.

Course Outcomes

On successful completion, students will be able to

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Contents

- This course covers the practical implementation of approaches and techniques covered in the preceding methodological course in a project-oriented setting. Each participant must produce a portfolio detailing and documenting the work. Porfolio themes are chosen from a list, or suggested by the students in accord with the tutor.

Literature
Compulsory Reading
Further Reading ▪ Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. Sebastopol, CA: O'Reilly. ▪ Marz, N., & Warren, J. (2015). Big data: Principles and best practices of scalable realtime data systems. Shelter Island, NY: Manning Publications. ▪ Matthias, K., & Kane, S. P. (2018). Docker: Up & running (2nd ed.). Sebastopol, CA: O'Reilly. ▪ Miell, I., & Sayers, A. (2019). Docker in practice (2nd ed.). Shelter Island, NY: Manning Publications. ▪ Muhammad, S., & Akhtar, F. (2018). Big data architect's handbook. Birmingham: Packt Publishing. ▪ Schenker, G. N. (2018). Learn Docker - Fundamentals of Docker 18.x: Get up and running with the concepts of Docker. Birmingham: Packt Publishing. ▪ Wilson, J., Redmond, E., & Perkins, L. (2018). Seven databases in seven weeks (2nd ed.). Raleigh, NC: Pragmatic Bookshelf.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

Data Analyst

Module Code: DLBDSEDA

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

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

Module Coordinator

N.N. (Advanced Data Analysis) / N.N. (Project: Data Analysis)

Contributing Courses to Module

- Advanced Data Analysis (DLBDSEDA01)
- Project: Data Analysis (DLBDSEDA02)

Module Exam Type

Module Exam	Split Exam
	Advanced Data Analysis • Study Format "Distance Learning": Exam, 90 Minutes Project: Data Analysis • Study Format "Distance Learning": Portfolio

Weight of Module

see curriculum

Module Contents

Advanced Data Analysis

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

Project: Data Analysis

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

Learning Outcomes

Advanced Data Analysis

On successful completion, students will be able to

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

Project: Data Analysis

On successful completion, students will be able to

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

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

Advanced Data Analysis

Course Code: DLBDSEDA01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

4. Social Network Mining
   - 4.1 Introduction to social media analytics
   - 4.2 Mining common social media platforms

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

Literature

Compulsory Reading

Further Reading

- Hapke, H. / Howard, C. / Lane, H. (2019): Natural language processing in action.: Manning Publications, Shelter Island, NY.
- Kaushik, A. (2009): Web analytics 2.0: The art of online accountability and science of customer centricity. Sybex, Hoboken, NJ.
- Klassen, M. / Russell, M. A. (2019): Mining the social web. 3rd edition. O'Reilly Media, Sebastopol, CA.
- Marr, B. (2012): Key Performance Indicators (KPI). Pearson, Boston, MA.
- Neely, A. (Ed.) (2011): Business performance measurement: Unifying theory and integrating practice. 2nd edition, Cambridge University Press, Cambridge.
- Ojeda, T. / Bilbro, R. / Bengfort, B. (2018): Applied text analysis with Python. O'Reilly Media, Sebastopol, CA.
- Parmenter, D. (2015): Key performance indicators: Developing, implementing, and using winning KPIs. 3rd edition, John Wiley & Sons, Chichester.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Data Analysis

Course Code: DLBDSEDA02

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

Literature
Compulsory Reading
Further Reading ▪ Hapke, H. / Howard, C. / Lane, H. (2019): Natural language processing in action.: Manning Publications, Shelter Island, NY. ▪ Kaushik, A. (2009): Web analytics 2.0: The art of online accountability and science of customer centricity. Sybex, Hoboken, NJ. ▪ Klassen, M. / Russell, M. A. (2019): Mining the social web. 3rd edition. O'Reilly Media, Sebastopol, CA. ▪ Marr, B. (2012): Key Performance Indicators (KPI). Pearson, Boston, MA. ▪ Neely, A. (Ed.) (2011): Business performance measurement: Unifying theory and integrating practice. 2nd edition, Cambridge University Press, Cambridge. ▪ Ojeda, T. / Bilbro, R. / Bengfort, B. (2018): Applied text analysis with Python. O'Reilly Media, Sebastopol, CA. ▪ Parmenter, D. (2015): Key performance indicators: Developing, implementing, and using winning KPIs. 3rd edition, John Wiley & Sons, Chichester.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

AI Specialist

Module Code: DLBDSEAIS

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

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

Module Coordinator

Prof. Dr. Ulrich Kerzel (Artificial Intelligence) / N.N. (Project: Artificial Intelligence)

Contributing Courses to Module

- Artificial Intelligence (DLBDSEAIS01)
- Project: Artificial Intelligence (DLBDSEAIS02)

Module Exam Type

Module Exam	Split Exam
	Artificial Intelligence • Study Format "Distance Learning": Exam, 90 Minutes Project: Artificial Intelligence • Study Format "Fernstudium": Portfolio

Weight of Module

see curriculum

Module Contents

Artificial Intelligence

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Project: Artificial Intelligence

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

Learning Outcomes

Artificial Intelligence

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Project: Artificial Intelligence

On successful completion, students will be able to

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

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

Artificial Intelligence

Course Code: DLBDSEAIS01

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

Course Description

The quest for artificial intelligence (AI) has captured humanity's interest for many decades and has been an active research area since the 1960s. This course will give a detailed overview of the historical developments, successes, and set-backs in AI, as well as modern approaches in the development of artificial intelligence.This course gives an introduction to reinforcement learning, a process similar to how humans and animals experience the world: exploring the environment and inferring the best course of action.This course also covers the principles of natural language processing and computer vision, both of which are key ingredients for an artificial intelligence to be able to interact with its environment.

Course Outcomes

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Contents

1. History of AI
   - 1.1 Historical developments
   - 1.2 AI winter
   - 1.3 Expert systems
   - 1.4 Notable advances
2. Modern AI Systems
   - 2.1 Narrow versus general AI
   - 2.2 Application areas
3. Reinforcement Learning
   - 3.1 What is reinforcement learning?
   - 3.2 Markov Chains and value function
   - 3.3 Time-difference and Q Learning

4. Natural Language Processing (NLP)
   - 4.1 Introduction to NLP and application areas
   - 4.2 Basic NLP techniques
   - 4.3 Vectorizing data

5. Computer Vision
   - 5.1 Pixels and filters
   - 5.2 Feature detection
   - 5.3 Distortions and calibration
   - 5.4 Semantic segmentation

Literature

Compulsory Reading

Further Reading

- Bear, F./Barry, W./Paradiso, M. (2006): Neuroscience: Exploring the brain. 3rd ed., Lippincott Williams and Wilkins, Baltimore, MD:
- Bird S./Klein, E./Loper, E. (2009): Natural language processing with Python. 2nd ed., O'Reilly, Sebastopol, CA.
- Chollet, F. (2017): Deep learning with Python. Manning, Shelter Island, NY.
- Fisher, R. B., et al. (2016) : Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- Geron, A. (2017): Hands-on machine learning with Scikit-Learn and TensorFlow. O'Reilly, Boston, MA.
- Goodfellow, I./Bengio, Y./Courville, A. (2016): Deep learning. MIT Press, Boston, MA.
- Grus, J. (2019): Data science from scratch: First principles with Python. O'Reilley, Sebastopol, CA.
- Jurafsky, D./Martin, J. H. (2008): Speech and language processing. Prentice Hall, Upper Saddle River, NJ.
- Nilsson, N. (2009): The quest for artificial intelligence. Cambridge University Press, Cambridge.
- Russell, S./Norvig, P. (2009): Artificial intelligence: A modern approach. 3rd ed., Pearson, Essex.
- Sutton, R./Barto, A. (2018): Reinforcement learning: An introduction. 2nd ed., MIT Press, Boston, MA.
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Szepesvári, C. (2010): Algorithms for reinforcement learning. Morgan & Claypool, San Rafael, CA.
- Wiering, M./Otterlo, M. (2012): Reinforcement learning: State of the art. Springer, Berlin.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Artificial Intelligence

Course Code: DLBDSEAIS02

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

Course Description

This project course will give students hands-on experience in the challenging task of designing and developing an AI system for a specific application and domain. Students will need to consider requirements and practical constraints as well as the desired output of the AI system.Following this course the students will get holistic overview of developing a specific AI-based application.

Course Outcomes

On successful completion, students will be able to

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

Contents

- This project course focuses on understanding and implementing a simple AI system. Based on the course Artificial Intelligence (DLBDSEAI01), students will design and implement a simple AI system. In the first step, students will choose a specific application and domain and then use the methods from the course to analyze the requirements and outcomes before implementing their own AI application. All relevant artifacts and considerations are documented by the students in a course portfolio.

Literature
Compulsory Reading
Further Reading ▪ Bear, F./Barry, W./Paradiso, M. (2006): Neuroscience: Exploring the brain. 3rd ed., Lippincott Williams and Wilkins, Baltimore, MD: ▪ Bird S./Klein, E./Loper, E. (2009): Natural language processing with Python. 2nd ed., O'Reilly, Sebastopol, CA. ▪ Chollet, F. (2017): Deep learning with Python. Manning, Shelter Island, NY. ▪ Fisher, R. B., et al. (2016) : Dictionary of computer vision and image processing. John Wiley & Sons, Chichester. ▪ Geron, A. (2017): Hands-on machine learning with Scikit-Learn and TensorFlow. O'Reilly, Boston, MA. ▪ Goodfellow, I./Bengio, Y./Courville, A. (2016): Deep learning. MIT Press, Boston, MA. ▪ Grus, J. (2019): Data science from scratch: First principles with Python. O'Reilley, Sebastopol, CA. ▪ Jurafsky, D./Martin, J. H. (2008): Speech and language processing. Prentice Hall, Upper Saddle River, NJ. ▪ Nilsson, N. (2009): The quest for artificial intelligence. Cambridge University Press, Cambridge. ▪ Russell, S./Norvig, P. (2009): Artificial intelligence: A modern approach. 3rd ed., Pearson, Essex. ▪ Sutton, R./Barto, A. (2018): Reinforcement learning: An introduction. 2nd ed., MIT Press, Boston, MA. ▪ Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden. ▪ Szepesvári, C. (2010): Algorithms for reinforcement learning. Morgan & Claypool, San Rafael, CA. ▪ Wiering, M./Otterlo, M. (2012): Reinforcement learning: State of the art. Springer, Berlin.

Study Format Fernstudium

Study Format	Course Type
Fernstudium	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

International Marketing and Branding

Module Code: DLBDSEIMB

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

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

Module Coordinator

Caterina Fox (International Marketing) / N.N. (International Brand Management)

Contributing Courses to Module

- International Marketing (DLBDSEIMB01)
- International Brand Management (DLBDSEIMB02)

Module Exam Type

Module Exam	Split Exam
	International Marketing • Study Format "Distance Learning": Exam, 90 Minutes International Brand Management • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

International Marketing

- International marketing strategy
- Cultural differences and their significance for marketing
- International marketing mix (product, price, promotion, and distribution decisions in an international environment)
- International market research and consumer behavior
- Ethical aspects in international marketing
- International marketing controlling and six sigma

International Brand Management

- Basics of brand management
- Framework conditions for brands in international markets
- Strategies and concepts of international brands
- Brand architectures and brand extension options
- Brand management and communication
- Brand management according to the stakeholder concept
- Brand control and protection

Learning Outcomes

International Marketing

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

International Brand Management

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Links to other Modules within the Study Program	Links to other Study Programs of IUBH
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

International Marketing

Course Code: DLBDSEIMB01

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

Course Description

Students are taught the necessity for strategic marketing in an international context. They will learn about essential cultural differences and their influences on international marketing management. The basic decisions, standardizations, and adaptations in international marketing are experienced by the students on the basis of different concepts in the international marketing mix. The necessity of international market research, strategic planning, and control are taught to the students, along with the ethical aspects in international marketing. The students analyze current topics in international marketing management and reflect on them in connection with the concepts they have learned in this course.

Course Outcomes

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

Contents

1. Strategic International Marketing
   - 1.1 Internationalization
   - 1.2 Theoretical Foundations of International Market Entry Strategies
   - 1.3 Forms of International Market Entry
2. Cultural Differences as an Aspect of International Marketing
   - 2.1 Overview of Culture
   - 2.2 Cultural Model Based on Hofstede
   - 2.3 Cultural Model Based on Trompenaars

3. Case Studies in International Market Entry and Marketing Strategies
   - 3.1 Case Study: Nivea in South Korea
   - 3.2 Case Study: Bosch and Siemens Hausgeräte GmbH in China
   - 3.3 Case Study: Siemens Mobile in China
   - 3.4 Case Study: Siemens in China

4. International Product Management and Product Development
   - 4.1 Goals of International Product Management
   - 4.2 Framework Conditions for International Product Management
   - 4.3 International Product Decisions
   - 4.4 International Product Development

5. Exchange Rate Fluctuations and International Price Calculation
   - 5.1 Tasks and Objectives of International Price Management
   - 5.2 Factors Influencing International Price Management
   - 5.3 Instruments of International Price Management

6. International Communication and International Sales Policy
   - 6.1 International Communication Management
   - 6.2 International Sales Management

7. International Marketing and Ethics
   - 7.1 Overview of International Marketing and Ethics
   - 7.2 Business Ethics in International Companies
   - 7.3 Case Study: Nestlé

8. Applied Market Research and Its Influence on Consumer Behavior
   - 8.1 Scope of International Market Research
   - 8.2 Requirements for International Market Research Information
   - 8.3 International Secondary Research
   - 8.4 International Primary Research

9. Monitoring and Control in International Marketing
   - 9.1 Controlling in International Management

10. Six Sigma, Brand Management, and Rebranding
    - 10.1 Six Sigma: Basics, Definitions, and Processes
    - 10.2 Brand Management
    - 10.3 Rebranding

Literature
Compulsory Reading
Further Reading ▪ Backhaus, K./Voeth, M. (2010): Internationales Marketing. Schäffer-Poeschel Stuttgart. ▪ Berndt, R./Altobelli, C. F./Sander, M. (2010): Internationales Marketing-Management. 4. Auflage, Springer, Berlin. ▪ Homburg, C./Krohmer, H. (2009): Marketingmanagement. Strategie – Instrumente – Umsetzung – Unternehmensführung. 3. Auflage, Gabler, Wiesbaden. ▪ Horx, M. (2005): Wie wir leben werden. Unsere Zukunft beginnt jetzt. Campus, Frankfurt a. M. ▪ Kotabe, M./Helsen, K. (2008): Global Marketing Management. 4. Auflage, Wiley, Hoboken (NJ). ▪ Kotler, P./Keller K. L./Bliemel, F. (2007): Marketing-Management. Strategien für wertschaffendes Handeln. 12. Auflage, Pearson Studium, Stuttgart.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

International Brand Management

Course Code: DLBDSEIMB02

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

Course Description

The aim of this course is to deepen and expand the knowledge acquired in the introductory elective course International Marketing. The value of a brand is a decisive competitive advantage for companies in international business. Brands create long-term and profitable customer relationships. Brands are therefore valuable assets for companies and organizations. Students learn the basics of brand management before moving on to the concepts and success factors of international brand management. Students also become familiar with the structure of brand architectures and the possibilities of brand extensions. The fact that different stakeholder groups must be taken into account in brand management is communicated to the students on the basis of the stakeholder concept. In addition, the students get to know the various methods for measuring brand value and brand controlling. The aspects of trademark protection that are particularly important in an international environment will be dealt with conclusively.

Course Outcomes

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Contents

1. Basics of Brand Management
   - 1.1 Brand Significance and Brand Understanding
   - 1.2 Market Conditions
   - 1.3 Tasks and Goals of Brand Management

2. Brand Identity, Brand Positioning, and Brand Personality
   - 2.1 Brand Identity as the Basis of Brand Management
   - 2.2 Brand Positioning
   - 2.3 Brand Image
   - 2.4 Brand Personality

3. Brand Strategies
   - 3.1 The Challenges for Brand Strategies
   - 3.2 Brand Strategies for New Products
   - 3.3 Trademark Licensing

4. International Branding
   - 4.1 Importance of Branding for International Companies
   - 4.2 Brand Concepts for International Brands
   - 4.3 Factors for Successful International Brands

5. Brand Architectures and Types of Branding
   - 5.1 Brand Systems
   - 5.2 Co-branding and Hybrid Branding

6. Brand Management and Communication
   - 6.1 Classic Brand Communication
   - 6.2 Brand Communication on the Internet

7. Brand Expansion
   - 7.1 Basics of Brand Expansion
   - 7.2 Opportunities and Risks of Brand Expansion
   - 7.3 Ideal Typical Sequence of the Brand Expansion Process

8. Brand Management According to the Stakeholder Concept
   - 8.1 Basics of Brand Management According to the Stakeholder Principle
   - 8.2 Stakeholder Groups: Consumer Stakeholder Groups
   - 8.3 Stakeholder Groups: Shareholders and Financial Investors
   - 8.4 Stakeholder Groups: Employees
   - 8.5 Stakeholder Groups: Suppliers and the Public

9. Brand Control
   - 9.1 Basics of Brand Controlling
   - 9.2 Importance and Measurement of Brand Value (Brand Status Analyses)
   - 9.3 Practical Methods for Measuring Brand Value

10. Trademark Protection
   - 10.1 Object of Trademark Protection
   - 10.2 Origin of Trademark Protection
   - 10.3 Trademark Infringements

Literature

Compulsory Reading

Further Reading

- Baumgarth, C. (2008): Markenpolitik. Markenwirkungen – Markenführung – Markencontrolling. 3. Auflage, Gabler, Wiesbaden.
- Berndt, R./Altobelli, C. F./Sander, M. (2010): Internationales Marketing-Management. 4. Auflage, Springer, Berlin.
- Esch, F.-R. (2010): Strategie und Technik der Markenführung. 6. Auflage, Vahlen, München.
- Gelder, S. v. (2003): Global Brand Strategy. Unlocking Brand Potential Across Countries, Cultures and Markets. Kogan Page, London.
- Homburg, C./Krohmer, H. (2009): Marketingmanagement. Strategie – Instrumente – Umsetzung – Unternehmensführung. 3. Auflage, Gabler, Wiesbaden.
- Keller, K. L. (2007): Strategic Brand Management. Building, Measuring and Managing Brand Equity. 3. Auflage, Prentice Hall International, Edinburgh.
- Kotler, P./Keller K. L./Bliemel, F. (2007): Marketing-Management. Strategien für wertschaffendes Handeln. 12. Auflage, Pearson Studium, Stuttgart.
- Meffert, H./Burmann, C./Koers, M. (Hrsg.) (2005): Markenmanagement. Identitätsorientierte Markenführung und praktische Umsetzung. 2. Auflage, Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Applied Sales

Module Code: DLBDSEAS

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

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

Module Coordinator

Prof. Dr. Patrick Geus (Applied Sales I) / Prof. Dr. Patrick Geus (Applied Sales II)

Contributing Courses to Module

- Applied Sales I (DLBDSEAS01)
- Applied Sales II (DLBDSEAS02)

Module Exam Type

Module Exam	Split Exam
	Applied Sales I • Study Format "Distance Learning": Exam Applied Sales II • Study Format "Distance Learning": Exam

Weight of Module

see curriculum

Module Contents

Applied Sales I

- Fundamentals of Applied Sales
- The Distribution System
- Personal Sales
- Sales Plans
- New Customer Acquisition
- A Sales Visit
- Conversational Tactics
- Conducting Negotiations
- Other Sales Channels

Applied Sales II

- Marketing and Sales
- Customer Satisfaction as a Success Factor
- Personalities in Sales
- Customer-Oriented Communication
- Presentation and Rhetoric
- Customer Loyalty
- Networking
- Case Study

Learning Outcomes

Applied Sales I

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Applied Sales II

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

Applied Sales I

Course Code: DLBDSEAS01

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

Course Description

The demands on sales thinking are growing every day. Globalized demand combined with high competition is making it increasingly difficult for companies to compete for customers. At the same time, customers are becoming better informed, while traditional supply markets are saturated and at overcapacity. In order to be successful in such an environment, sales thinking and action are required along with a new type of salesperson. Within the course Applied Sales I (Introduction), the participants are familiarized with the basic concepts of applied sales. You will learn about sales organization, dealing with alternative sales channels, and get to know the dedicated sales planning process. The contents of the module are complemented by the successful acquisition of new customers, whereby particular attention is paid to the organization and implementation of customer visits and the conduct of discussions and negotiations.

Course Outcomes

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Contents

1. Fundamentals of Applied Sales and Distribution
   - 1.1 Tasks and Forms of Applied Distribution
   - 1.2 Marketing as the Basis of Sales
   - 1.3 Distribution, Sales, and Other Terms
   - 1.4 Sales in Different Economic Sectors

2. The Distribution System
   - 2.1 Forms of Sales
   - 2.2 Sales Organisation
   - 2.3 Key Account Management
   - 2.4 Multi-Channel Distribution

3. Personal Sales
   - 3.1 The "New Sellers"
   - 3.2 Requirements for Sales Personalities
   - 3.3 The Key Account Manager
   - 3.4 Task of Sales Managers

4. Sales Plan
   - 4.1 Tasks and Objectives of Sales Management
   - 4.2 Observation of Competition in the Context of Sales Management
   - 4.3 Potential Analyses and Sales Planning
   - 4.4 Sales Control and Visit Strategies

5. New Customer Acquisition
   - 5.1 Identification of New Customer Potential
   - 5.2 Customer Relationship Management and Customer Acquisition
   - 5.3 Trade Fairs and Events
   - 5.4 Networking

6. The Sales Visit
   - 6.1 Frequency and Preparation of Visits
   - 6.2 Conduct of a Visit
   - 6.3 Visit Reports and Follow-Up
   - 6.4 Aftercare and Follow-Up

7. Conversational Tactics
   - 7.1 Structured Conversation Preparation
   - 7.2 Goal-Oriented Conversation: The D.A.L.A.S Model
   - 7.3 Questioning Techniques

8. Conducting Negotiations
   - 8.1 Psychology of Negotiation
   - 8.2 Negotiation Structure
   - 8.3 Objection Handling
   - 8.4 Price Negotiations

9. Other Sales Channels
   - 9.1 Telemarketing
   - 9.2 Catalogue and Brochure Sales
   - 9.3 Internet and E-Commerce

Literature

Compulsory Reading

Further Reading

- Dannenberg, H./Zupancic, D. (2010): Spitzenleistungen im Vertrieb. Optimierungen im Vertriebs- und Kundenmanagement. 2. Auflage, Gabler, Wiesbaden.
- Eicher, H. (2006): Die geheimen Spielregeln im Verkauf. Wissen, wie der Kunde tickt. Campus, Frankfurt a. M.
- Herndl, K. (2014): Führen im Vertrieb. So unterstützen Sie Ihre Mitarbeiter direkt und konsequent. 4. Auflage, Gabler, Wiesbaden.
- Limbeck, M. (2016): Das neue Hardselling. Verkaufen heißt verkaufen – So kommen Sie zum Abschluss. 6. Auflage, Gabler, Wiesbaden.
- Schneider, W./Henning, A. (2008): Lexikon Kennzahlen für Marketing und Vertrieb. Das Marketing-Cockpit von A – Z. 2. Auflage, Springer, Berlin/Heidelberg.
- Winkelmann, P. (2012): Marketing und Vertrieb. Fundamente für die Marktorientierte Unternehmensführung. 8. Auflage, Oldenbourg, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Applied Sales II

Course Code: DLBDSEAS02

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

Course Description

The course Applied Sales II builds on the basics taught in the course "Applied Sales I" and broadens and deepens them. First, the tension between marketing and sales is examined in more detail. Based on this, essential backgrounds and central target figures for successful sales management (e.g., customer satisfaction and loyalty as well as the customer life cycle) are derived and operationalized in order to create the basis for efficient and effective customer relationship management. As the process progresses, attention will also be paid to mental processes and consumer behavior in general. In addition, strategies and paths to successful negotiation are deepened and supplemented by convincing communication techniques. The course concludes with a case study in the course of which the students have the opportunity to apply what they have learned in a practice-oriented manner.

Course Outcomes

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Contents

8. Case Study in IQ Media Marketing
   - 8.1 The Market Situation
   - 8.2 The Marketing Situation
   - 8.3 IQ Media Marketing and IQ Digital Media Marketing

Literature

Compulsory Reading

Further Reading

- Dannenberg, H./Zupancic, D. (2010): Spitzenleistungen im Vertrieb. Optimierungen im Vertriebs- und Kundenmanagement. 2. Auflage, Gabler, Wiesbaden.
- Eicher, H. (2006): Die geheimen Spielregeln im Verkauf. Wissen, wie der Kunde tickt. Campus, Frankfurt a. M.
- Herndl, K. (2014): Führen im Vertrieb. So unterstützen Sie Ihre Mitarbeiter direkt und konsequent. 4. Auflage, Gabler, Wiesbaden.
- Limbeck, M. (2016): Das neue Hardselling. Verkaufen heißt verkaufen – So kommen Sie zum Abschluss. 6. Auflage, Gabler, Wiesbaden.
- Schneider, W./Henning, A. (2008): Lexikon Kennzahlen für Marketing und Vertrieb. Das Marketing-Cockpit von A – Z. 2. Auflage, Springer, Berlin/Heidelberg.
- Winkelmann, P. (2012): Marketing und Vertrieb. Fundamente für die Marktorientierte Unternehmensführung. 8. Auflage, Oldenbourg, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Supply Chain Management

Module Code: DLBDSESCM

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

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

Module Coordinator

N.N. (Supply Chain Management I) / N.N. (Supply Chain Management II)

Contributing Courses to Module

- Supply Chain Management I (DLBDSESCM01)
- Supply Chain Management II (DLBDSESCM02)

Module Exam Type

Module Exam	Split Exam
	Supply Chain Management I • Study Format "Distance Learning": Module Exam (50) Supply Chain Management II • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

Supply Chain Management I

- Historical and terminological aspects of the SCM concept
- Motives for the creation of cross-company value creation networks
- Design principles and effects of value creation networks
- Logistical core processes and SCM
- Information technology aspects of the SCM concept
- Coordination and collaboration of the network partners
- Industry-specific solutions of the SCM

Supply Chain Management II

- Strategic aspects of SCM
- SCM Practice: Tasks and Activities in the Core Planning Process
- SCM Practice: Tasks and Activities in the Core Process of Procurement
- SCM Practice: Tasks and Activities in the Core Process Production
- SCM Practice: Tasks and Activities in the Core Distribution Process

Learning Outcomes

Supply Chain Management I

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Supply Chain Management II

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the fields of Logistics & Transportation	All Bachelor Programmes in the Transport & Logistics fields

Supply Chain Management I

Course Code: DLBDSESCM01

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

Course Description

SCM proves to be an extremely multi-faceted construct from both a theoretical and a practical point of view. An adequate understanding of the problem dimensions and modes of action of (global) cross-company value creation networks requires a multidimensional approach. It starts by considering logistical processes, with modern process, flow, and network standards forming an important basis for SCM. On the basis of such an approach, students should gain a fundamental understanding of SCM. From the point of view of a holistic approach, it also makes sense to also examine a number of other typical problem areas in addition to the logistical challenges of this concept. This includes IT aspects of SCM (e.g., APS systems), and questions to do with the collaboration and coordination of network partners. This course also considers selected industry specific SCM solutions (ECR or VMI).

Course Outcomes

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Contents

1. Fundamentals of the Supply Chain Concept
   - 1.1 Terminological and Conceptual Fundamentals
   - 1.2 Supply Chain Typology According to Otto
   - 1.3 Supply Chain Typology According to Bechtel/Jayaram
   - 1.4 Dynamic Aspects of Supply Chains

Literature
Compulsory Reading
Further Reading ▪ Arndt, H. (2018): Supply Chain Management. Optimierung logistischer Prozesse. 7. Auflage, Gabler, Wiesbaden. ▪ Grosche, P. (2012): Konfiguration und Koordination von Wertschöpfungsaktivitäten in internationalen Unternehmen. Eine empirische Untersuchung in der Automobilindustrie. Gabler-Verlag, Wiesbaden. ▪ Heiserich, O.E./Helbig, K./Ullmann, W. (2011): Logistik. Eine praxisorientierte Einführung. 4. Auflage, Gabler-Verlag | Springer Fachmedien, Wiesbaden 2011. ▪ Hertel, J./Zentes, J./Schramm-Klein, H. (2011): Supply-Chain-Management und Warenwirtschaftssysteme im Handel. 2. Auflage, Springer Verlag, Heidelberg. ▪ Hungenberg, H. (2014): Strategisches Management in Unternehmen. Ziele-Prozesse-Verfahren. 8. Auflage, Wiesbaden. ▪ Pfohl, H. C. (2010): Logistiksysteme. Betriebswirtschaftliche Grundlagen. 8 Auflage, Springer, Berlin. ▪ Schulte, C. (2013): Logistik. Wege zur Optimierung der Supply Chain. 6. Auflage, Vahlen, München. ▪ Werner, H. (2013): Supply Chain Management. Grundlagen, Strategien, Instrumente und Controlling. 5. Auflage, Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Supply Chain Management II

Course Code: DLBDSESCM02

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

Course Description

From the perspective of strategic management research and practice, the activities covered by the term SCM are closely related to efforts to build and/or maintain a stable operational competitive advantage. A fundamental discussion of this relationship forms the starting point for the course. On this basis, a differentiated analysis of strategy-relevant activities and instruments in the Plan, Source, Make, Deliver, and Return process categories is then carried out using the SCOR model. Special attention is given to the practice-relevant areas of SCM, e.g., order-promising (plan), supplier-relation-management (source), postponement (make), and the ECR-concept (deliver).

Course Outcomes

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Contents

1. Strategic Aspects of SCM
   - 1.1 Strategic Thinking and Action: General Information
   - 1.2 Competition Focus and SCM
   - 1.3 Competition Location and SCM
   - 1.4 Competition Rules and SCM

2. SCM Practice: Core Process Planning
   - 2.1 General Preliminary Considerations
   - 2.2 Collaborative Planning, Forecasting, and Replenishment
   - 2.3 Order Promoting
   - 2.4 Kanban
   - 2.5 Integration of X-PL Logistics Service Providers

3. SCM Practice: Core Process Procurement
   - 3.1 General Preliminary Considerations
   - 3.2 Production Synchronous Procurement
   - 3.3 Sourcing Concepts
   - 3.4 Supplier Relations Management

4. SCM Practice: Core Process Production
   - 4.1 Selected Aspects of the Problem Background
   - 4.2 Collaborative Engineering
   - 4.3 Postponement Strategies
   - 4.4 Value Added Partnership

5. SCM Practice: Core Process Distribution
   - 5.1 Basic Information on the Distribution Problem
   - 5.2 Efficient Consumer Response (ECR)
   - 5.3 Consignment Warehouse

Literature
Compulsory Reading
Further Reading ▪ Arndt, H. (2018): Supply Chain Management. Optimierung logistischer Prozesse. 7. Auflage, Gabler, Wiesbaden. ▪ Grosche, P. (2012): Konfiguration und Koordination von Wertschöpfungsaktivitäten in internationalen Unternehmen. Eine empirische Untersuchung in der Automobilindustrie. Gabler-Verlag, Wiesbaden. ▪ Heiserich, O.E./Helbig, K./Ullmann, W. (2011): Logistik. Eine praxisorientierte Einführung. 4. Auflage, Gabler-Verlag | Springer Fachmedien, Wiesbaden 2011. ▪ Hertel, J./Zentes, J./Schramm-Klein, H. (2011): Supply-Chain-Management und Warenwirtschaftssysteme im Handel. 2. Auflage, Springer Verlag, Heidelberg. ▪ Hungenberg, H. (2014): Strategisches Management in Unternehmen. Ziele-Prozesse-Verfahren. 8. Auflage, Wiesbaden. ▪ Pfohl, H. C. (2010): Logistiksysteme. Betriebswirtschaftliche Grundlagen. 8 Auflage, Springer, Berlin. ▪ Schulte, C. (2013): Logistik. Wege zur Optimierung der Supply Chain. 6. Auflage, Vahlen, München. ▪ Werner, H. (2013): Supply Chain Management. Grundlagen, Strategien, Instrumente und Controlling. 5. Auflage, Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSESCM02

Financial Services Management

Module Code: DLBDSEFSM

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

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

Module Coordinator

N.N. (Financial Services Management I) / N.N. (Financial Services Management II)

Contributing Courses to Module

- Financial Services Management I (DLBDSEFSM01)
- Financial Services Management II (DLBDSEFSM02)

Module Exam Type

Module Exam	Split Exam
	Financial Services Management I • Study Format "Distance Learning": Module Exam (50) Financial Services Management II • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

Financial Services Management I

- Financial Markets and Financial Intermediaries
- Financial Intermediation in Germany
- Financial Services
- Debt Financing Through Financial Intermediaries
- Equity Financing Through Financial Intermediaries

Financial Services Management II

- Fundamentals of the Monetary and Asset Situation
- Investment in Money
- Investment in Tangible Assets
- Investment Funds and Certificates
- Insurance Financial Services

Learning Outcomes

Financial Services Management I

On successful completion, students will be able to

- know the role of a financial service provider as a financier as well as how individual markets function in the financing sector.
- understand the basic relationships between the different financial services and their (supervisory) legal frameworks.
- evaluate the potential influence of the financial services sector on the real economy.
- familiarize themselves with the financing services offered both for external financing and for self-financing.
- assess the importance of financial services in the form of debt and equity financing in the short, medium, and long term.

Financial Services Management II

On successful completion, students will be able to

- systematize the different possibilities for the investment of financial surpluses.
- with the help of knowledge gained regarding conflicts involved in making financial investments, apply different aspects of investment decision-making to financial instruments.
- assess the various forms of investment in order of their safety.
- analyze the various forms of investment in terms of risk and return.
- understand that investment funds, certificates, and derivatives are modern products of financial service providers, which bring high returns and sometimes high risk.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the fields of Finance & Tax Accounting	All Bachelor Programmes in the Business & Management fields

Financial Services Management I

Course Code: DLBDSEFSM01

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

Course Description

The course explains the origin and constitution of the financial market. As a result of the imperfection of the financial market, the necessity of financial intermediaries is theoretically derived, which leads to the thesis of disintermediation. Since the German financial market is determined by regulations and supervision, the legal framework is discussed. The financial services of banks and other specialized financial intermediaries are presented. The main forms of debt financing through financial intermediaries are presented as well as financing with equity capital.

Course Outcomes

On successful completion, students will be able to

- know the role of a financial service provider as a financier as well as how individual markets function in the financing sector.
- understand the basic relationships between the different financial services and their (supervisory) legal frameworks.
- evaluate the potential influence of the financial services sector on the real economy.
- familiarize themselves with the financing services offered both for external financing and for self-financing.
- assess the importance of financial services in the form of debt and equity financing in the short, medium, and long term.

Contents

1. Financial Markets and Financial Intermediaries
   - 1.1 Origin and Basic Problems of the Financial Market
   - 1.2 Appearances and Functions of Financial Intermediaries
   - 1.3 The Thesis of Disintermediation in Finance
2. Financial Intermediation in Germany
   - 2.1 The Banking System in Germany
   - 2.2 Capital Management Companies and Insurance Companies
   - 2.3 Regulations and Supervision

3. Financial Services
   - 3.1 Financing Needs
   - 3.2 The Range of Financial Services
   - 3.3 Lending and Collateralization

4. Debt Financing Through Financial Intermediaries
   - 4.1 Short-Term Loans as a Financing Service
   - 4.2 Medium and Long-Term Loans as Financial Services
   - 4.3 Credit Substitutes

5. Equity Financing Through Financial Intermediaries
   - 5.1 Equity Financing Through Capital Participation and Venture Financing Companies
   - 5.2 Services in Connection With Issue Financing

Literature

Compulsory Reading

Further Reading

- Bitz, M./Stark, G. (2008): Finanzdienstleistungen. 8. Auflage, Oldenbourg, München/Wien.
- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10. Auflage, McGraw-Hill, London.
- Copeland, T. E./Weston, J. F./Shastri, K. (2008): Finanzierungstheorie und Unternehmenspolitik. 4. Auflage, Pearson, München.
- Hartmann-Wendels, T./Pfingsten, A./Weber. M. (2006): Bankbetriebslehre. 4. Auflage, Springer, Berlin.
- Perridon, L./Steiner, M./Rathgeber, A. W. (2009): Finanzwirtschaft der Unternehmung. 15. Auflage, Vahlen, München.
- Wöhe, G. et al. (2009): Grundzüge der Unternehmensfinanzierung. 10. Auflage, Vahlen, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Financial Services Management II

Course Code: DLBDSEFSM02

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

Course Description

In this course, the different possibilities of investing financial surpluses are systematized. The conflicting relationship between the risks, returns, and liquidity of a financial investment are presented, and the different aspects of decision-making for investment in one of the financial instruments are shown. The various forms of investment (monetary values, tangible assets) are presented in the order of their security. The functions that insurance companies perform as financial service providers complete the picture. The different forms of life insurance and their role in old-age provision are presented.

Course Outcomes

On successful completion, students will be able to

- systematize the different possibilities for the investment of financial surpluses.
- with the help of knowledge gained regarding conflicts involved in making financial investments, apply different aspects of investment decision-making to financial instruments.
- assess the various forms of investment in order of their safety.
- analyze the various forms of investment in terms of risk and return.
- understand that investment funds, certificates, and derivatives are modern products of financial service providers, which bring high returns and sometimes high risk.

Contents

1. Basic Information on Investing Money and Assets
   - 1.1 Basic Concepts of Money and Asset Investment
   - 1.2 Framework Conditions for Decisions on Plants
   - 1.3 Investment Products
2. Investment in Money
   - 2.1 Investment in Accounts
   - 2.2 Savings Bonds
   - 2.3 Fixed-Interest Securities

3. Investment in Tangible Assets
   - 3.1 Shares
   - 3.2 Stock Exchange Trading
   - 3.3 Investment in Real Estate

4. Investment Funds and Certificates
   - 4.1 Mutual Funds
   - 4.2 Fund of Funds and Hedge Funds
   - 4.3 Derivatives

5. Insurance Financial Services
   - 5.1 Fundamentals of the Insurance Industry
   - 5.2 The Life Insurances

Literature

Compulsory Reading

Further Reading

- Bitz, M./Stark, G. (2008): Finanzdienstleistungen. 8. Auflage, Oldenbourg, München/Wien.
- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10. Auflage, McGraw-Hill, London.
- Copeland, T. E./Weston, J. F./Shastri, K. (2008): Finanzierungstheorie und Unternehmenspolitik. 4. Auflage, Pearson, München.
- Hartmann-Wendels, T./Pfingsten, A./Weber. M. (2006): Bankbetriebslehre. 4. Auflage, Springer, Berlin.
- Perridon, L./Steiner, M./Rathgeber, A. W. (2009): Finanzwirtschaft der Unternehmung. 15. Auflage, Vahlen, München.
- Wöhe, G. et al. (2009): Grundzüge der Unternehmensfinanzierung. 10. Auflage, Vahlen, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☑ Exam Template	

Smart Factory

Module Code: DLBDSESF

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

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

Module Coordinator

N.N. (Smart Factory I) / Prof. Dr. Christian Magnus (Smart Factory II)

Contributing Courses to Module

- Smart Factory I (DLBDSESF01)
- Smart Factory II (DLBDSESF02)

Module Exam Type

Module Exam	Split Exam
	Smart Factory I • Study Format "Distance Learning": Exam, 90 Minutes Smart Factory II • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Smart Factory I

- Motivation and Definition of Terms
- Development of Automation
- Technological Basics and Standards
- Basic concepts of a Smart Factory
- Reference Architectures
- Smart Factory Engineering
- Safety and Security

Smart Factory II

A catalogue with the currently provided tasks is provided on the online platform of the module. It provides the content basis of the module and can be supplemented or updated by the seminar leader.

Learning Outcomes

Smart Factory I

On successful completion, students will be able to

- understand the term Smart Factory in the context of Industry 4.0.
- be able to trace the development of automation to a fully autonomous, non-centrally organized production plant.
- understand the basic technologies and standards used to design and operate a Smart Factory.
- understand the essential concepts of a Smart Factory.
- identify and differentiate between the individual elements of a Smart Factory using different reference architectures.
- understand the special engineering challenges in the Smart Energy context.
- understand the special safety risks of digitized and networked production plants and assign concrete recommendations for action.

Smart Factory II

On successful completion, students will be able to

- have a deeper understanding of the technologies and standards in the context of Smart Factory.
- apply technologies in the context of Smart Factory to a simple practical example.
- design a hardware or software prototype for a selected task.
- document, design, and develop activities in the form of a project report.

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

Smart Factory I

Course Code: DLBDSESF01

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

Course Description

In this course, students will gain a deeper insight into the networking and digitization of production facilities by examining a Smart Factory. For this purpose, they will be familiarized with the basic goals of a Smart Factory in the context of the research complex Industry 4.0. After a brief introduction to the history of automation, students will learn the technical basics and standards required to design and operate a Smart Factory. Building on this, they will learn how these individual technologies are used to implement the central concepts of a Smart Factory. In order to understand which components a Smart Factory consists of, different reference architectures are presented and compared. The course concludes with the special engineering challenges of an autonomously acting and decentralized production plant. Above all, this includes IT security, which is particularly relevant due to the digital networking of production facilities and products.

Course Outcomes

On successful completion, students will be able to

- understand the term Smart Factory in the context of Industry 4.0.
- be able to trace the development of automation to a fully autonomous, non-centrally organized production plant.
- understand the basic technologies and standards used to design and operate a Smart Factory.
- understand the essential concepts of a Smart Factory.
- identify and differentiate between the individual elements of a Smart Factory using different reference architectures.
- understand the special engineering challenges in the Smart Energy context.
- understand the special safety risks of digitized and networked production plants and assign concrete recommendations for action.

Contents

1. Motivation and Definition of Terms
   - 1.1 Goals of Smart Factory
   - 1.2 Internet of Things
   - 1.3 Cyber-Physical Systems
   - 1.4 Cyber-Physical Production Systems
   - 1.5 Smart Factory as a Cyber-Physical (Production) System

2. Development of Automation
   - 2.1 Automation Pyramid
   - 2.2 Networked, Decentralized Organization of Production
   - 2.3 Future Challenges

3. Technological Basics and Standards
   - 3.1 Identification of Physical Objects
   - 3.2 Formal Description Languages and Ontologies
   - 3.3 Digital Object Memory
   - 3.4 Physical Situation Recognition
   - 3.5 (Partially) Autonomous Action and Cooperation
   - 3.6 Human-Machine Interaction
   - 3.7 Machine to Machine Communication

4. Basic Concepts of a Smart Factory
   - 4.1 Order-Controlled Production
   - 4.2 Bundling of Machine and Production Data
   - 4.3 Supporting People in Production
   - 4.4 Intelligent Products and Resources
   - 4.5 Smart Services

5. Reference Architectures
   - 5.1 Purpose and Properties of Reference Architectures
   - 5.2 Overview of Standardization Initiatives
   - 5.3 CyProS Reference Architecture
   - 5.4 RAMI 4.0 (DIN SPEC 91345)

6. Smart Factory Engineering
   - 6.1 Classification of Different Engineering Tools
   - 6.2 Virtual Engineering
   - 6.3 User-Centered Design
   - 6.4 Requirements Engineering
   - 6.5 Modelling
   - 6.6 Integration of Classic and Smart Components

Literature
Compulsory Reading
Further Reading ▪ Bangemann, T. et al. (2016): Integration of Classical Components into Industrial Cyber–Physical Systems. In: Proceedings of the IEEE, 104. Jg., Heft 5, S. 947–959. DOI: 10.1109/JPROC.2015.2510981. ▪ Bauernhansl, T./Hompel, M. ten/Vogel-Heuser, B. (Hrsg.) (2014): Industrie 4.0 in Produktion, Automatisierung und Logistik. Springer, Berlin. ▪ Bundesministerium für Wirtschaft und Energie (Hrsg.) (2016): IT-Sicherheit für die Industrie 4.0. Produktion, Produkte, Dienste von morgen im Zeichen globalisierter Wertschöpfungsketten. Berlin. ▪ Geisberger, E./Broy, M. (Hrsg.) (2012): agendaCPS. Integrierte Forschungsagenda Cyber-Physical Systems. Springer, Berlin/Heidelberg. ▪ Harrison, R./Vera, D.; Ahmad, B. (2016): Engineering Methods and Tools for Cyber–Physical Automation Systems. In: Proceedings of the IEEE, 104. Jg., Heft 5, S. 973–985. DOI: 10.1109/JPROC.2015.2510665. ▪ Haupert, J. (2013): DOMeMan: Repräsentation, Verwaltung und Nutzung von digitalen Objektgedächtnissen. Akademische Verlagsgesellschaft AKA, Berlin. ▪ VDMA & Partner (2016): Leitfaden Industrie 4.0 Security. Handlungsempfehlungen für den Mittelstand. VDMA Verlag, Frankfurt a. M.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Smart Factory II

Course Code: DLBDSESF02

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

Course Description

In this course, students select a concrete task from the catalog of topics provided in consultation with the seminar leader. They will work on the task in a prototyping environment suited to the task, which can be either a hardware (e.g., prototyping boards) or software (e.g., technology-specific development environments) environment. To complete the task, students apply the concepts, methods, and tools taught in the Smart Factory I course. They document their results with a project report.

Course Outcomes

On successful completion, students will be able to

- have a deeper understanding of the technologies and standards in the context of Smart Factory.
- apply technologies in the context of Smart Factory to a simple practical example.
- design a hardware or software prototype for a selected task.
- document, design, and develop activities in the form of a project report.

Contents

- A catalogue with the currently provided tasks is provided on the online platform of the module. It provides the content basis of the module and can be supplemented or updated by the seminar leader.

Literature

Compulsory Reading

Further Reading

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSESF02

Automation and Robotics

Module Code: DLBDSEAR

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	▪ none ▪ DLBDSEAR01	BA	10	300 h

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

Module Coordinator

Prof. Dr. Mario Boßlau (Production Engineering) / N.N. (Automation and Robotics)

Contributing Courses to Module

- Production Engineering (DLBDSEAR01)
- Automation and Robotics (DLBDSEAR02)

Module Exam Type

Module Exam	Split Exam
	Production Engineering • Study Format "Distance Learning": Exam, 90 Minutes (50) Automation and Robotics • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

Production Engineering

- Introduction to Manufacturing Technology
- Main Production Groups According to DIN 8580
- Additive Manufacturing Processes
- Rapid Prototyping
- Rapid Tooling
- Direct/Rapid Manufacturing
- Cyber-Physical Production Plants

Automation and Robotics

- Basics of Automation
- Fundamentals of Measurement Technology
- Sensors
- Basics of Control Engineering
- Basics of Control Technology
- Introduction to Robotics
- Kinematics of a Robot

Learning Outcomes

Production Engineering

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Automation and Robotics

On successful completion, students will be able to

- understand the basic aspects of automation.
- understand the different sizes and units in measurement technology.
- differentiate between different measurement methods.
- understand the basic structure of measuring equipment.
- select a suitable sensor based on various criteria.
- understand the elements of control systems.
- describe the behavior of control systems in the time and frequency domain.
- understand the basic principles of control technology.
- convert between different number systems and apply Boolean algebra.
- understand the structure of switching networks, plants, and storages.
- understand important elements of control systems such as signal generators and power amplifiers.
- design simple programmable logic controllers.
- understand the basic structure of industrial robots.
- calculate different movements and positions of jointed-arm robots.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the field of Engineering	All Bachelor Programmes in the IT & Technology fields

Production Engineering

Course Code: DLBDSEAR01

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

Course Description

The aim of the course is to provide students with an overview of the processes that have influenced and still influence production processes through technological developments under the generic term Industry 4.0, based on traditional, standardized manufacturing techniques. These include, in particular, technological advances in additive manufacturing processes that enable applications such as rapid prototyping, rapid tooling, and direct manufacturing. Finally, the course deals with the consequences of the digitalization and networking of production facilities and their elements in the sense of a cyber-physical system.

Course Outcomes

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Contents

1. Introduction to Manufacturing Technology
   - 1.1 Basic Terms and Contexts in Manufacturing Theory
   - 1.2 Historical Development of Production
   - 1.3 The Discussion About the Long Tail

2. Main Production Groups According to DIN 8580
   - 2.1 Archetypes
   - 2.2 Reshaping
   - 2.3 Cutting (Cutting, Machining, Ablation)
   - 2.4 Joining
   - 2.5 Coating
   - 2.6 Substance Property Changes

3. Additive Manufacturing Processes
   - 3.1 Basic Principles and Legal Aspects
   - 3.2 Stereolithography (STL)
   - 3.3 Selective Laser Sintering and Selective Beam Melting With Laser or Electron Beam
   - 3.4 Fused Deposition Modeling (FDM)
   - 3.5 Multi-Jet Modeling (MJM) and Poly-Jet Process (PJM)
   - 3.6 3D Printing Process (3DP)
   - 3.7 Laminating Processes
   - 3.8 Mask Sintering

4. Rapid Prototyping
   - 4.1 Definition
   - 4.2 Strategic and Operational Aspects
   - 4.3 Application Areas and Examples

5. Rapid Tooling
   - 5.1 Definition, Strategic, and Operational Aspects
   - 5.2 Indirect and Direct Procedures

6. Direct/Rapid Manufacturing
   - 6.1 Potentials and Requirements for Procedures
   - 6.2 Implementation, Application Areas, and Examples

7. Cyber-Physical Production Plants
   - 7.1 Derivation of the Terms Industry 4.0 and Cyber-Physical Systems
   - 7.2 Megatrend Cyber Physical Systems (CPS)
   - 7.3 Definition Cyber-Physical Production Plant
   - 7.4 Effects on Planning and Operation of Production Facilities
   - 7.5 Dynamic Reconfiguration and Migration of Production Facilities

Literature
Compulsory Reading
Further Reading ▪ Anderson, C. (2012): Makers. The new industrial revolution. Crown Business, New York. ▪ Bauernhansl, Thomas/Hompel, M. ten/Vogel-Heuser, B. (Hrsg.) (2014): Industrie 4.0 in Produktion, Automatisierung und Logistik. Anwendung – Technologien – Migration. Springer, Wiesbaden. ▪ Gebhardt, A. (2012): Understanding Additive Manufacturing. Rapid Prototyping – Rapid Tooling – Rapid Manufacturing. Hanser, München/Cincinnati. ▪ Lachmayer, R./Lippert, R. B./Fahlbusch, T. (Hrsg.) (2016): 3D-Druck beleuchtet. Additive Manufacturing auf dem Weg in die Anwendung. Springer, Berlin/Heidelberg. ▪ Wittenstein, M. et al. (Hrsg.) (2015): Intelligente Vernetzung in der Fabrik. Industrie 4.0. Umsetzungsbeispiele für die Praxis. Fraunhofer Verlag, Stuttgart.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Automation and Robotics

Course Code: DLBDSEAR02

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSEAR01

Course Description

The aim of the course is to provide students with an insight into measurement, control, and regulation technology and convey the basics of robotics. Students will be taught which methods can be used to determine certain measured variables and how measurement errors are dealt with. Based on these fundamentals, various sensors will be presented and students will be able to select suitable sensors based on predefined criteria. The course also introduces students to the basics of control engineering. The different ways of describing the structure and behaviour of control systems are illustrated to the students. The basics of control engineering are also taught. The students receive a short introduction to binary number systems and Boolean algebra, and deal with various basal circuit and control elements. Finally, students will gain an insight into robotics with a focus on industrial robots. In this context, the students learn the description and calculation of positions and movements of individual limbs of a robot arm.

Course Outcomes

On successful completion, students will be able to

- understand the basic aspects of automation.
- understand the different sizes and units in measurement technology.
- differentiate between different measurement methods.
- understand the basic structure of measuring equipment.
- select a suitable sensor based on various criteria.
- understand the elements of control systems.
- describe the behavior of control systems in the time and frequency domain.
- understand the basic principles of control technology.
- convert between different number systems and apply Boolean algebra.
- understand the structure of switching networks, plants, and storages.
- understand important elements of control systems such as signal generators and power amplifiers.
- design simple programmable logic controllers.
- understand the basic structure of industrial robots.
- calculate different movements and positions of jointed-arm robots.

Contents

5. Basics of Control Technology
   - 5.1 Basic Principle and Elements of Control Systems
   - 5.2 Numerical Representations
   - 5.3 Boolean Algebra
   - 5.4 Switching Networks, Plants, and Storage Facilities
   - 5.5 Signal Generators and Power Amplifiers
   - 5.6 Programmable Logic Controllers
   - 5.7 Connection-Programmed Controls

6. Introduction to Robotics
   - 6.1 Terms and Classification
   - 6.2 Basic Elements
   - 6.3 Classification of Robots

7. Kinematics of a Robot
   - 7.1 Coordinate Systems and Reference Points
   - 7.2 Rotations
   - 7.3 Forward and Reverse Transformations
   - 7.4 Denavit-Hartenberg Transformation

Literature

Compulsory Reading

Further Reading

- Heinrich, B./Linke, P./Glöckler, M. (2015): Grundlagen Automatisierung. Springer, Wiesbaden.
- Hesse, S./Malisa, V. (Hrsg.) (2016): Taschenbuch Robotik – Montage – Handhabung. 2. Auflage, Carl Hanser Verlag, München.
- Jazar, R. N. (2010): Theory of Applied Robotics. 2. Auflage, Springer US, Boston (MA).
- Karaali, C. (2013): Grundlagen der Steuerungstechnik. Springer, Wiesbaden.
- Parthier, R. (2011): Messtechnik. Grundlagen und Anwendungen der elektrischen Messtechnik für alle technischen Fachrichtungen und Wirtschaftsingenieure. 6. Auflage, Vieweg & Teubner, Wiesbaden.
- Tietze, U./Schenk, C./Gamm, E. (2016): Halbleiter-Schaltungstechnik. 15. Auflage, Springer, Berlin.
- Zacher, S./Reuter, M. (2014): Regelungstechnik für Ingenieure. Springer, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSEAR02

Autonomous Driving

Module Code: DLBDSEAD

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	150 h

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

Module Coordinator

N.N. (Self-Driving Vehicles) / N.N. (Seminar: Current Topics and Trends in Self-Driving Technology)

Contributing Courses to Module

- Self-Driving Vehicles (DLBDSEAD01)
- Seminar: Current Topics and Trends in Self-Driving Technology (DLBDSEAD02)

Module Exam Type

Module Exam	Split Exam
	Self-Driving Vehicles • Study Format "Distance Learning": Exam, 90 Minutes (50) Seminar: Current Topics and Trends in Self-Driving Technology • Study Format "Distance Learning": Written Assessment: Research Essay (50)

Weight of Module

see curriculum

Module Contents

Self-Driving Vehicles

- Safety standards
- Sensor fusion
- Computer vision
- Localization & motion
- Motion planning

Seminar: Current Topics and Trends in Self-Driving Technology

The seminar covers current topics of autonomous vehicles. The choice of topics can include (but are not limited to) recent technical advances as well as philosophical issues or implications for society, law, or relevant industries.

Learning Outcomes

Self-Driving Vehicles

On successful completion, students will be able to

- cite relevant safety standards.
- grasp the concepts of sensors and sensor fusion.
- apply computer vision techniques to detect features.
- evaluate images in terms of semantic segmentation.
- understand motion models and localization approaches.
- utilize motion planning techniques.

Seminar: Current Topics and Trends in Self-Driving Technology

On successful completion, students will be able to

- transfer theoretical knowledge and methods to new domains.
- understand recent developments in self-driving vehicles.
- create new insights based on detailed studies of current research and technology.

Links to other Modules within the Study Program	Links to other Study Programs of IUBH
This module is similar to other modules in the field of Engineering	All Bachelor Programmes in the IT & Technology fields

Self-Driving Vehicles

Course Code: DLBDSEAD01

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

Course Description

This course focuses on the foundations of autonomous vehicles and starts with a detailed introduction to relevant safety standards in terms of functional and IT security.This course continues with a presentation of the concept of sensor fusion and discusses relevant aspects of computer vision techniques such as feature detection, calibration, and semantic segmentation.A large part of the course concerns localization and motion planning. Relevant motion models are introduced and localization techniques such as odometry, triangulation, and satellite-based systems are discussed in detail, along with path planning, motion prediction, and trajectory generation.

Course Outcomes

On successful completion, students will be able to

- cite relevant safety standards.
- grasp the concepts of sensors and sensor fusion.
- apply computer vision techniques to detect features.
- evaluate images in terms of semantic segmentation.
- understand motion models and localization approaches.
- utilize motion planning techniques.

Contents

1. Sensors
   - 1.1 Physical principles of sensors
   - 1.2 Types of sensors
   - 1.3 Sensor calibaration
   - 1.4 Application scenarios
2. Sensor Fusion
   - 2.1 Elaborating data from sensors
   - 2.2 Kalman filter
   - 2.3 Object tracking

3. Computer Vision
   - 3.1 Pixels and filters
   - 3.2 Feature detection
   - 3.3 Distortions and calibration
   - 3.4 Semantic segmentation

4. Localization & Motion
   - 4.1 Motion models
   - 4.2 Odometry
   - 4.3 Triangulation
   - 4.4 Satellite-based localization

5. Motion planning
   - 5.1 Path planning
   - 5.2 Motion prediction
   - 5.3 Trajectory generation

6. Safety Standards
   - 6.1 Functional Safety
   - 6.2 IT Security Standards
   - 6.3 Safety development approaches

Literature

Compulsory Reading

Further Reading

- Ben-Ari, M./Mondada, F. (2018): Elements of robotics. Springer, Cham.
- European Union. (2001).:Directive 2001/95/EG. (URL: https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32001L0095 [Retrieved: 28.02.2020])
- Fisher, R. B., et al. (2016): Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- International Electrotechnical Commission. (2015): IEC 61508. (URL: https://www.iec.ch/functionalsafety/ [Retrieved: 28.02.2020])
- International Organization for Standardization. (2009): ISO 15408. (URL: https://www.iso.org/standard/50341.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 25119. (URL: https://www.iso.org/standard/69026.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 26262. (URL: https://www.iso.org/standard/68383.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (n.d.): ISO 21434. (URL: https://www.iso.org/standard/70918.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO/IEC 27001. (URL: https://www.iso.org/isoiec-27001-information-security.html [Retrieved: 28.02.2020])
- Rausand, M. (2014): Reliability of safety-critical systems: Theory and applications. Wiley, Hoboken, NJ.
- Smith, D. J./Simpson, K. (2016): The safety critical systems handbook. 4th ed., Elsevier, Oxford.
- Smith, D. J. (2017): Reliability, maintainability and risk. 9th ed., Elsevier, Oxford.
- Society of Automobile Engineers International. (2012): SAE J3061. (URL: https://www.sae.org/standards/content/j3061/ [Retrieved: 28.02.2020])
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Wang, P. K.-C. (2015): Visibility-based optimal path and motion planning (vol. 568). Springer, Cham.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Seminar: Current Topics and Trends in Self-Driving Technology

Course Code: DLBDSEAD02

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

Course Description

This courses focuses on recent developments in the field of self-driving vehicles. Following the course Self-Driving Vehicles (DLBDSEAD01), in this course students will focus on a particular topic in the context of autonomous driving, applying the knowledge they have obtained in the first course.Finally, a research essay will be written.

Course Outcomes

On successful completion, students will be able to

- transfer theoretical knowledge and methods to new domains.
- understand recent developments in self-driving vehicles.
- create new insights based on detailed studies of current research and technology.

Contents

- The seminar covers current topics of autonomous vehicles. The choice of topics can include (but are not limited to) recent technical advances as well as philosophical issues or implications for society, law, or relevant industries.

Literature

Compulsory Reading

Further Reading

- Ben-Ari, M./Mondada, F. (2018): Elements of robotics. Springer, Cham.
- European Union. (2001).:Directive 2001/95/EG. (URL: https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32001L0095 [Retrieved: 28.02.2020])
- Fisher, R. B., et al. (2016): Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- International Electrotechnical Commission. (2015): IEC 61508. (URL: https://www.iec.ch/functionalsafety/ [Retrieved: 28.02.2020])
- International Organization for Standardization. (2009): ISO 15408. (URL: https://www.iso.org/standard/50341.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 25119. (URL: https://www.iso.org/standard/69026.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 26262. (URL: https://www.iso.org/standard/68383.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (n.d.): ISO 21434. (URL: https://www.iso.org/standard/70918.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO/IEC 27001. (URL: https://www.iso.org/isoiec-27001-information-security.html [Retrieved: 28.02.2020])
- Marchthaler, R./Dingler, S. (2017): Kalman-Filter. Springer, Wiesbaden.
- Rausand, M. (2014): Reliability of safety-critical systems: Theory and applications. Wiley, Hoboken, NJ.
- Smith, D. J./Simpson, K. (2016): The safety critical systems handbook. 4th ed., Elsevier, Oxford.
- Smith, D. J. (2017): Reliability, maintainability and risk. 9th ed., Elsevier, Oxford.
- Society of Automobile Engineers International. (2012): SAE J3061. (URL: https://www.sae.org/standards/content/j3061/ [Retrieved: 28.02.2020])
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Wang, P. K.-C. (2015): Visibility-based optimal path and motion planning (vol. 568). Springer, Cham.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Seminar

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Research Essay

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSEAD02

6. Semester

Data Engineer

Module Code: DLBDSEDE

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

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

Module Coordinator

N.N. (Data Engineering) / N.N. (Project: Data Engineering)

Contributing Courses to Module

- Data Engineering (DLBDSEDE01)
- Project: Data Engineering (DLBDSEDE02)

Module Exam Type

Module Exam	Split Exam
	Data Engineering • Study Format "Distance Learning": Exam, 90 Minutes Project: Data Engineering • Study Format "Distance Learning": Portfolio

Weight of Module

see curriculum

Module Contents

Data Engineering

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Project: Data Engineering

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Learning Outcomes

Data Engineering

On successful completion, students will be able to

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Project: Data Engineering

On successful completion, students will be able to

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the field(s) of Data Science & Artificial Intelligence.	All Bachelor Programmes in the IT & Technology field(s).

Data Engineering

Course Code: DLBDSEDE01

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

Course Description

This course explores concepts of data engineering. Data engineering is concerned with the infrastructure aspects of data science such as data storage and provision, as well as the provisioning of suitable operational environments.After laying out foundational notions and concepts of the discipline, this course addresses important developments in storage technology; aspects of systems architecture for processing data at scale; containerization as a modern take on virtualization; and the logic of data pipelines and associated operational aspects. Important issues pertaining to data security and protection are also given appropriate attention.

Course Outcomes

On successful completion, students will be able to

- understand important foundational concepts in data engineering.
- recognize established and commonly-employed NoSQL datastores and their salient characteristics.
- comprehend common architectural patterns for data processing at scale.
- explain the concept of containerization as a virtualization approach.
- analyze operational challenges in the set-up and maintenance of data pipelines.
- demonstrate familiarity with concepts relating to data security and protection.

Contents

1. Foundations of Data Engineering
   - 1.1 Reliability
   - 1.2 Scalability
   - 1.3 Maintainability
2. NoSQL In Depth
   - 2.1 Fundamentals of NoSQL
   - 2.2 Established NoSQL solutions
3. Architectures for Data Processing at Scale
   - 3.1 Batch processing architectures
   - 3.2 Architectures for stream and complex event processing
   - 3.3 Lambda architecture

4. Containerization In Depth
   - 4.1 Docker containers
   - 4.2 Container management
5. Governance & Security
   - 5.1 Data protection
   - 5.2 Data security
   - 5.3 Data governance
6. Operational Aspects
   - 6.1 Defining principles of DataOps
   - 6.2 Building and maintaining data pipelines
   - 6.3 Metrics and monitoring

Literature

Compulsory Reading

Further Reading

- Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. Sebastopol, CA: O'Reilly.
- Marz, N., & Warren, J. (2015). Big data: Principles and best practices of scalable realtime data systems. Shelter Island, NY: Manning Publications.
- Matthias, K., & Kane, S. P. (2018). Docker: Up & running (2nd ed.). Sebastopol, CA: O'Reilly.
- Miell, I., & Sayers, A. (2019). Docker in practice (2nd ed.). Shelter Island, NY: Manning Publications.
- Muhammad, S., & Akhtar, F. (2018). Big data architect's handbook. Birmingham: Packt Publishing.
- Schenker, G. N. (2018). Learn Docker - Fundamentals of Docker 18.x: Get up and running with the concepts of Docker. Birmingham: Packt Publishing.
- Wilson, J., Redmond, E., & Perkins, L. (2018). Seven databases in seven weeks (2nd ed.). Raleigh, NC: Pragmatic Bookshelf.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Data Engineering

Course Code: DLBDSEDE02

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

Course Description

The focus of this course is the implementation of a real-world data engineering use case in the form of a student portfolio. To this end, students choose a project subject from the various sub-domains of data engineering. Examples include setting up a Docker container environment or dockerized service; implementing a data pipeline according to DataOps principles; and setting up an NoSQL data store.The goal is for students to demonstrate they can transfer theoretical knowledge to an implementation scenario that closely mimics practical work in a professional data engineering setting.

Course Outcomes

On successful completion, students will be able to

- formulate and implement a real-world data engineering use case.
- select appropriate resources for the task at hand.
- transfer acquired specialized knowledge in data engineering to a real-world use case.
- derive relevant design choices from the given project setting.
- analyze the suitability of different solution options with respect to the project task.
- make apposite choices with respect to implementation alternatives.

Contents

- This course covers the practical implementation of approaches and techniques covered in the preceding methodological course in a project-oriented setting. Each participant must produce a portfolio detailing and documenting the work. Porfolio themes are chosen from a list, or suggested by the students in accord with the tutor.

Literature
Compulsory Reading
Further Reading ▪ Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. Sebastopol, CA: O'Reilly. ▪ Marz, N., & Warren, J. (2015). Big data: Principles and best practices of scalable realtime data systems. Shelter Island, NY: Manning Publications. ▪ Matthias, K., & Kane, S. P. (2018). Docker: Up & running (2nd ed.). Sebastopol, CA: O'Reilly. ▪ Miell, I., & Sayers, A. (2019). Docker in practice (2nd ed.). Shelter Island, NY: Manning Publications. ▪ Muhammad, S., & Akhtar, F. (2018). Big data architect's handbook. Birmingham: Packt Publishing. ▪ Schenker, G. N. (2018). Learn Docker - Fundamentals of Docker 18.x: Get up and running with the concepts of Docker. Birmingham: Packt Publishing. ▪ Wilson, J., Redmond, E., & Perkins, L. (2018). Seven databases in seven weeks (2nd ed.). Raleigh, NC: Pragmatic Bookshelf.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

Data Analyst

Module Code: DLBDSEDA

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

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

Module Coordinator

N.N. (Advanced Data Analysis) / N.N. (Project: Data Analysis)

Contributing Courses to Module

- Advanced Data Analysis (DLBDSEDA01)
- Project: Data Analysis (DLBDSEDA02)

Module Exam Type

Module Exam	Split Exam
	Advanced Data Analysis • Study Format "Distance Learning": Exam, 90 Minutes Project: Data Analysis • Study Format "Distance Learning": Portfolio

Weight of Module

see curriculum

Module Contents

Advanced Data Analysis

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

Project: Data Analysis

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

Learning Outcomes

Advanced Data Analysis

On successful completion, students will be able to

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

Project: Data Analysis

On successful completion, students will be able to

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

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

Advanced Data Analysis

Course Code: DLBDSEDA01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

4. Social Network Mining
   - 4.1 Introduction to social media analytics
   - 4.2 Mining common social media platforms

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

Literature

Compulsory Reading

Further Reading

- Hapke, H. / Howard, C. / Lane, H. (2019): Natural language processing in action.: Manning Publications, Shelter Island, NY.
- Kaushik, A. (2009): Web analytics 2.0: The art of online accountability and science of customer centricity. Sybex, Hoboken, NJ.
- Klassen, M. / Russell, M. A. (2019): Mining the social web. 3rd edition. O'Reilly Media, Sebastopol, CA.
- Marr, B. (2012): Key Performance Indicators (KPI). Pearson, Boston, MA.
- Neely, A. (Ed.) (2011): Business performance measurement: Unifying theory and integrating practice. 2nd edition, Cambridge University Press, Cambridge.
- Ojeda, T. / Bilbro, R. / Bengfort, B. (2018): Applied text analysis with Python. O'Reilly Media, Sebastopol, CA.
- Parmenter, D. (2015): Key performance indicators: Developing, implementing, and using winning KPIs. 3rd edition, John Wiley & Sons, Chichester.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Data Analysis

Course Code: DLBDSEDA02

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

Literature
Compulsory Reading
Further Reading ▪ Hapke, H. / Howard, C. / Lane, H. (2019): Natural language processing in action.: Manning Publications, Shelter Island, NY. ▪ Kaushik, A. (2009): Web analytics 2.0: The art of online accountability and science of customer centricity. Sybex, Hoboken, NJ. ▪ Klassen, M. / Russell, M. A. (2019): Mining the social web. 3rd edition. O'Reilly Media, Sebastopol, CA. ▪ Marr, B. (2012): Key Performance Indicators (KPI). Pearson, Boston, MA. ▪ Neely, A. (Ed.) (2011): Business performance measurement: Unifying theory and integrating practice. 2nd edition, Cambridge University Press, Cambridge. ▪ Ojeda, T. / Bilbro, R. / Bengfort, B. (2018): Applied text analysis with Python. O'Reilly Media, Sebastopol, CA. ▪ Parmenter, D. (2015): Key performance indicators: Developing, implementing, and using winning KPIs. 3rd edition, John Wiley & Sons, Chichester.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

AI Specialist

Module Code: DLBDSEAIS

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

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

Module Coordinator

Prof. Dr. Ulrich Kerzel (Artificial Intelligence) / N.N. (Project: Artificial Intelligence)

Contributing Courses to Module

- Artificial Intelligence (DLBDSEAIS01)
- Project: Artificial Intelligence (DLBDSEAIS02)

Module Exam Type

Module Exam	Split Exam
	Artificial Intelligence • Study Format "Distance Learning": Exam, 90 Minutes Project: Artificial Intelligence • Study Format "Fernstudium": Portfolio

Weight of Module

see curriculum

Module Contents

Artificial Intelligence

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Project: Artificial Intelligence

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

Learning Outcomes

Artificial Intelligence

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Project: Artificial Intelligence

On successful completion, students will be able to

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

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

Artificial Intelligence

Course Code: DLBDSEAIS01

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

Course Description

The quest for artificial intelligence (AI) has captured humanity's interest for many decades and has been an active research area since the 1960s. This course will give a detailed overview of the historical developments, successes, and set-backs in AI, as well as modern approaches in the development of artificial intelligence.This course gives an introduction to reinforcement learning, a process similar to how humans and animals experience the world: exploring the environment and inferring the best course of action.This course also covers the principles of natural language processing and computer vision, both of which are key ingredients for an artificial intelligence to be able to interact with its environment.

Course Outcomes

On successful completion, students will be able to

- chart the historical developments in artificial intelligence.
- understand the approach of contemporary AI systems.
- comprehend the concepts behind reinforcement learning.
- analyze natural language using basic NLP techniques.
- scrutinize images and their contents.

Contents

1. History of AI
   - 1.1 Historical developments
   - 1.2 AI winter
   - 1.3 Expert systems
   - 1.4 Notable advances
2. Modern AI Systems
   - 2.1 Narrow versus general AI
   - 2.2 Application areas
3. Reinforcement Learning
   - 3.1 What is reinforcement learning?
   - 3.2 Markov Chains and value function
   - 3.3 Time-difference and Q Learning

4. Natural Language Processing (NLP)
   - 4.1 Introduction to NLP and application areas
   - 4.2 Basic NLP techniques
   - 4.3 Vectorizing data

5. Computer Vision
   - 5.1 Pixels and filters
   - 5.2 Feature detection
   - 5.3 Distortions and calibration
   - 5.4 Semantic segmentation

Literature

Compulsory Reading

Further Reading

- Bear, F./Barry, W./Paradiso, M. (2006): Neuroscience: Exploring the brain. 3rd ed., Lippincott Williams and Wilkins, Baltimore, MD:
- Bird S./Klein, E./Loper, E. (2009): Natural language processing with Python. 2nd ed., O'Reilly, Sebastopol, CA.
- Chollet, F. (2017): Deep learning with Python. Manning, Shelter Island, NY.
- Fisher, R. B., et al. (2016) : Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- Geron, A. (2017): Hands-on machine learning with Scikit-Learn and TensorFlow. O'Reilly, Boston, MA.
- Goodfellow, I./Bengio, Y./Courville, A. (2016): Deep learning. MIT Press, Boston, MA.
- Grus, J. (2019): Data science from scratch: First principles with Python. O'Reilley, Sebastopol, CA.
- Jurafsky, D./Martin, J. H. (2008): Speech and language processing. Prentice Hall, Upper Saddle River, NJ.
- Nilsson, N. (2009): The quest for artificial intelligence. Cambridge University Press, Cambridge.
- Russell, S./Norvig, P. (2009): Artificial intelligence: A modern approach. 3rd ed., Pearson, Essex.
- Sutton, R./Barto, A. (2018): Reinforcement learning: An introduction. 2nd ed., MIT Press, Boston, MA.
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Szepesvári, C. (2010): Algorithms for reinforcement learning. Morgan & Claypool, San Rafael, CA.
- Wiering, M./Otterlo, M. (2012): Reinforcement learning: State of the art. Springer, Berlin.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Project: Artificial Intelligence

Course Code: DLBDSEAIS02

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

Course Description

This project course will give students hands-on experience in the challenging task of designing and developing an AI system for a specific application and domain. Students will need to consider requirements and practical constraints as well as the desired output of the AI system.Following this course the students will get holistic overview of developing a specific AI-based application.

Course Outcomes

On successful completion, students will be able to

- determine the requirements for building an artificial intelligence system.
- evaluate an application for an AI system.
- transfer theoretically-sound and practically-proven methods and tools to an application domain.
- create an AI system for a chosen application.

Contents

- This project course focuses on understanding and implementing a simple AI system. Based on the course Artificial Intelligence (DLBDSEAI01), students will design and implement a simple AI system. In the first step, students will choose a specific application and domain and then use the methods from the course to analyze the requirements and outcomes before implementing their own AI application. All relevant artifacts and considerations are documented by the students in a course portfolio.

Literature

Compulsory Reading

Further Reading

- Bear, F./Barry, W./Paradiso, M. (2006): Neuroscience: Exploring the brain. 3rd ed., Lippincott Williams and Wilkins, Baltimore, MD:
- Bird S./Klein, E./Loper, E. (2009): Natural language processing with Python. 2nd ed., O'Reilly, Sebastopol, CA.
- Chollet, F. (2017): Deep learning with Python. Manning, Shelter Island, NY.
- Fisher, R. B., et al. (2016) : Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- Geron, A. (2017): Hands-on machine learning with Scikit-Learn and TensorFlow. O'Reilly, Boston, MA.
- Goodfellow, I./Bengio, Y./Courville, A. (2016): Deep learning. MIT Press, Boston, MA.
- Grus, J. (2019): Data science from scratch: First principles with Python. O'Reilley, Sebastopol, CA.
- Jurafsky, D./Martin, J. H. (2008): Speech and language processing. Prentice Hall, Upper Saddle River, NJ.
- Nilsson, N. (2009): The quest for artificial intelligence. Cambridge University Press, Cambridge.
- Russell, S./Norvig, P. (2009): Artificial intelligence: A modern approach. 3rd ed., Pearson, Essex.
- Sutton, R./Barto, A. (2018): Reinforcement learning: An introduction. 2nd ed., MIT Press, Boston, MA.
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Szepesvári, C. (2010): Algorithms for reinforcement learning. Morgan & Claypool, San Rafael, CA.
- Wiering, M./Otterlo, M. (2012): Reinforcement learning: State of the art. Springer, Berlin.

Study Format Fernstudium

Study Format	Course Type
Fernstudium	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Portfolio

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

International Marketing and Branding

Module Code: DLBDSEIMB

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

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

Module Coordinator

Caterina Fox (International Marketing) / N.N. (International Brand Management)

Contributing Courses to Module

- International Marketing (DLBDSEIMB01)
- International Brand Management (DLBDSEIMB02)

Module Exam Type

Module Exam	Split Exam
	International Marketing • Study Format "Distance Learning": Exam, 90 Minutes International Brand Management • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

International Marketing

- International marketing strategy
- Cultural differences and their significance for marketing
- International marketing mix (product, price, promotion, and distribution decisions in an international environment)
- International market research and consumer behavior
- Ethical aspects in international marketing
- International marketing controlling and six sigma

International Brand Management

- Basics of brand management
- Framework conditions for brands in international markets
- Strategies and concepts of international brands
- Brand architectures and brand extension options
- Brand management and communication
- Brand management according to the stakeholder concept
- Brand control and protection

Learning Outcomes

International Marketing

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

International Brand Management

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Links to other Modules within the Study Program	Links to other Study Programs of IUBH
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

International Marketing

Course Code: DLBDSEIMB01

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

Course Description

Students are taught the necessity for strategic marketing in an international context. They will learn about essential cultural differences and their influences on international marketing management. The basic decisions, standardizations, and adaptations in international marketing are experienced by the students on the basis of different concepts in the international marketing mix. The necessity of international market research, strategic planning, and control are taught to the students, along with the ethical aspects in international marketing. The students analyze current topics in international marketing management and reflect on them in connection with the concepts they have learned in this course.

Course Outcomes

On successful completion, students will be able to

- understand basic aspects of international strategic marketing.
- analyze cultural differences and their impact on international marketing.
- apply selected concepts of the international marketing mix.
- describe the possibilities of international market research and its influence on consumer behavior.
- recognize the necessity of international brand controlling and quality management.
- reproduce theoretical knowledge using case studies.

Contents

1. Strategic International Marketing
   - 1.1 Internationalization
   - 1.2 Theoretical Foundations of International Market Entry Strategies
   - 1.3 Forms of International Market Entry
2. Cultural Differences as an Aspect of International Marketing
   - 2.1 Overview of Culture
   - 2.2 Cultural Model Based on Hofstede
   - 2.3 Cultural Model Based on Trompenaars

3. Case Studies in International Market Entry and Marketing Strategies
   - 3.1 Case Study: Nivea in South Korea
   - 3.2 Case Study: Bosch and Siemens Hausgeräte GmbH in China
   - 3.3 Case Study: Siemens Mobile in China
   - 3.4 Case Study: Siemens in China

4. International Product Management and Product Development
   - 4.1 Goals of International Product Management
   - 4.2 Framework Conditions for International Product Management
   - 4.3 International Product Decisions
   - 4.4 International Product Development

5. Exchange Rate Fluctuations and International Price Calculation
   - 5.1 Tasks and Objectives of International Price Management
   - 5.2 Factors Influencing International Price Management
   - 5.3 Instruments of International Price Management

6. International Communication and International Sales Policy
   - 6.1 International Communication Management
   - 6.2 International Sales Management

7. International Marketing and Ethics
   - 7.1 Overview of International Marketing and Ethics
   - 7.2 Business Ethics in International Companies
   - 7.3 Case Study: Nestlé

8. Applied Market Research and Its Influence on Consumer Behavior
   - 8.1 Scope of International Market Research
   - 8.2 Requirements for International Market Research Information
   - 8.3 International Secondary Research
   - 8.4 International Primary Research

9. Monitoring and Control in International Marketing
   - 9.1 Controlling in International Management

10. Six Sigma, Brand Management, and Rebranding
    - 10.1 Six Sigma: Basics, Definitions, and Processes
    - 10.2 Brand Management
    - 10.3 Rebranding

Literature
Compulsory Reading
Further Reading ▪ Backhaus, K./Voeth, M. (2010): Internationales Marketing. Schäffer-Poeschel Stuttgart. ▪ Berndt, R./Altobelli, C. F./Sander, M. (2010): Internationales Marketing-Management. 4. Auflage, Springer, Berlin. ▪ Homburg, C./Krohmer, H. (2009): Marketingmanagement. Strategie – Instrumente – Umsetzung – Unternehmensführung. 3. Auflage, Gabler, Wiesbaden. ▪ Horx, M. (2005): Wie wir leben werden. Unsere Zukunft beginnt jetzt. Campus, Frankfurt a. M. ▪ Kotabe, M./Helsen, K. (2008): Global Marketing Management. 4. Auflage, Wiley, Hoboken (NJ). ▪ Kotler, P./Keller K. L./Bliemel, F. (2007): Marketing-Management. Strategien für wertschaffendes Handeln. 12. Auflage, Pearson Studium, Stuttgart.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

International Brand Management

Course Code: DLBDSEIMB02

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

Course Description

The aim of this course is to deepen and expand the knowledge acquired in the introductory elective course International Marketing. The value of a brand is a decisive competitive advantage for companies in international business. Brands create long-term and profitable customer relationships. Brands are therefore valuable assets for companies and organizations. Students learn the basics of brand management before moving on to the concepts and success factors of international brand management. Students also become familiar with the structure of brand architectures and the possibilities of brand extensions. The fact that different stakeholder groups must be taken into account in brand management is communicated to the students on the basis of the stakeholder concept. In addition, the students get to know the various methods for measuring brand value and brand controlling. The aspects of trademark protection that are particularly important in an international environment will be dealt with conclusively.

Course Outcomes

On successful completion, students will be able to

- recognize the significance of a brand and the general conditions under which brands operate, as well as the associated tasks of brand management.
- describe the components of a brand and its management.
- explain the positioning of brands on regional, national and international markets.
- understand the role of brand evaluation and compare the most common measurement techniques.
- give an overview of the importance of trademark protection and suggest strategies for preventing counterfeiting.
- conceive of brand strategies and measures for the avoidance or occurrence of brand crises.

Contents

1. Basics of Brand Management
   - 1.1 Brand Significance and Brand Understanding
   - 1.2 Market Conditions
   - 1.3 Tasks and Goals of Brand Management

2. Brand Identity, Brand Positioning, and Brand Personality
   - 2.1 Brand Identity as the Basis of Brand Management
   - 2.2 Brand Positioning
   - 2.3 Brand Image
   - 2.4 Brand Personality

3. Brand Strategies
   - 3.1 The Challenges for Brand Strategies
   - 3.2 Brand Strategies for New Products
   - 3.3 Trademark Licensing

4. International Branding
   - 4.1 Importance of Branding for International Companies
   - 4.2 Brand Concepts for International Brands
   - 4.3 Factors for Successful International Brands

5. Brand Architectures and Types of Branding
   - 5.1 Brand Systems
   - 5.2 Co-branding and Hybrid Branding

6. Brand Management and Communication
   - 6.1 Classic Brand Communication
   - 6.2 Brand Communication on the Internet

7. Brand Expansion
   - 7.1 Basics of Brand Expansion
   - 7.2 Opportunities and Risks of Brand Expansion
   - 7.3 Ideal Typical Sequence of the Brand Expansion Process

8. Brand Management According to the Stakeholder Concept
   - 8.1 Basics of Brand Management According to the Stakeholder Principle
   - 8.2 Stakeholder Groups: Consumer Stakeholder Groups
   - 8.3 Stakeholder Groups: Shareholders and Financial Investors
   - 8.4 Stakeholder Groups: Employees
   - 8.5 Stakeholder Groups: Suppliers and the Public

9. Brand Control
   - 9.1 Basics of Brand Controlling
   - 9.2 Importance and Measurement of Brand Value (Brand Status Analyses)
   - 9.3 Practical Methods for Measuring Brand Value

10. Trademark Protection
   - 10.1 Object of Trademark Protection
   - 10.2 Origin of Trademark Protection
   - 10.3 Trademark Infringements

Literature

Compulsory Reading

Further Reading

- Baumgarth, C. (2008): Markenpolitik. Markenwirkungen – Markenführung – Markencontrolling. 3. Auflage, Gabler, Wiesbaden.
- Berndt, R./Altobelli, C. F./Sander, M. (2010): Internationales Marketing-Management. 4. Auflage, Springer, Berlin.
- Esch, F.-R. (2010): Strategie und Technik der Markenführung. 6. Auflage, Vahlen, München.
- Gelder, S. v. (2003): Global Brand Strategy. Unlocking Brand Potential Across Countries, Cultures and Markets. Kogan Page, London.
- Homburg, C./Krohmer, H. (2009): Marketingmanagement. Strategie – Instrumente – Umsetzung – Unternehmensführung. 3. Auflage, Gabler, Wiesbaden.
- Keller, K. L. (2007): Strategic Brand Management. Building, Measuring and Managing Brand Equity. 3. Auflage, Prentice Hall International, Edinburgh.
- Kotler, P./Keller K. L./Bliemel, F. (2007): Marketing-Management. Strategien für wertschaffendes Handeln. 12. Auflage, Pearson Studium, Stuttgart.
- Meffert, H./Burmann, C./Koers, M. (Hrsg.) (2005): Markenmanagement. Identitätsorientierte Markenführung und praktische Umsetzung. 2. Auflage, Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Applied Sales

Module Code: DLBDSEAS

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

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

Module Coordinator

Prof. Dr. Patrick Geus (Applied Sales I) / Prof. Dr. Patrick Geus (Applied Sales II)

Contributing Courses to Module

- Applied Sales I (DLBDSEAS01)
- Applied Sales II (DLBDSEAS02)

Module Exam Type

Module Exam	Split Exam
	Applied Sales I • Study Format "Distance Learning": Exam Applied Sales II • Study Format "Distance Learning": Exam

Weight of Module

see curriculum

Module Contents

Applied Sales I

- Fundamentals of Applied Sales
- The Distribution System
- Personal Sales
- Sales Plans
- New Customer Acquisition
- A Sales Visit
- Conversational Tactics
- Conducting Negotiations
- Other Sales Channels

Applied Sales II

- Marketing and Sales
- Customer Satisfaction as a Success Factor
- Personalities in Sales
- Customer-Oriented Communication
- Presentation and Rhetoric
- Customer Loyalty
- Networking
- Case Study

Learning Outcomes

Applied Sales I

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Applied Sales II

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the fields of Marketing & Sales	All Bachelor Programmes in the Marketing & Communication fields

Applied Sales I

Course Code: DLBDSEAS01

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

Course Description

The demands on sales thinking are growing every day. Globalized demand combined with high competition is making it increasingly difficult for companies to compete for customers. At the same time, customers are becoming better informed, while traditional supply markets are saturated and at overcapacity. In order to be successful in such an environment, sales thinking and action are required along with a new type of salesperson. Within the course Applied Sales I (Introduction), the participants are familiarized with the basic concepts of applied sales. You will learn about sales organization, dealing with alternative sales channels, and get to know the dedicated sales planning process. The contents of the module are complemented by the successful acquisition of new customers, whereby particular attention is paid to the organization and implementation of customer visits and the conduct of discussions and negotiations.

Course Outcomes

On successful completion, students will be able to

- understand the fundamentals of applied sales and place them in the context of the company.
- understand the interaction of the individual facets of applied sales.
- differentiate between and evaluate individual sales systems.
- describe current sales types and sales characteristics.
- oversee and classify the entire sales process from customer acquisition to customer retention.
- understand the basics of sales and negotiation management and apply them.
- name the usual sales instruments, recognize their advantages and disadvantages, and reflect on essential fields of application and possibilities.

Contents

1. Fundamentals of Applied Sales and Distribution
   - 1.1 Tasks and Forms of Applied Distribution
   - 1.2 Marketing as the Basis of Sales
   - 1.3 Distribution, Sales, and Other Terms
   - 1.4 Sales in Different Economic Sectors

2. The Distribution System
   - 2.1 Forms of Sales
   - 2.2 Sales Organisation
   - 2.3 Key Account Management
   - 2.4 Multi-Channel Distribution

3. Personal Sales
   - 3.1 The "New Sellers"
   - 3.2 Requirements for Sales Personalities
   - 3.3 The Key Account Manager
   - 3.4 Task of Sales Managers

4. Sales Plan
   - 4.1 Tasks and Objectives of Sales Management
   - 4.2 Observation of Competition in the Context of Sales Management
   - 4.3 Potential Analyses and Sales Planning
   - 4.4 Sales Control and Visit Strategies

5. New Customer Acquisition
   - 5.1 Identification of New Customer Potential
   - 5.2 Customer Relationship Management and Customer Acquisition
   - 5.3 Trade Fairs and Events
   - 5.4 Networking

6. The Sales Visit
   - 6.1 Frequency and Preparation of Visits
   - 6.2 Conduct of a Visit
   - 6.3 Visit Reports and Follow-Up
   - 6.4 Aftercare and Follow-Up

7. Conversational Tactics
   - 7.1 Structured Conversation Preparation
   - 7.2 Goal-Oriented Conversation: The D.A.L.A.S Model
   - 7.3 Questioning Techniques

8. Conducting Negotiations
   - 8.1 Psychology of Negotiation
   - 8.2 Negotiation Structure
   - 8.3 Objection Handling
   - 8.4 Price Negotiations

9. Other Sales Channels
   - 9.1 Telemarketing
   - 9.2 Catalogue and Brochure Sales
   - 9.3 Internet and E-Commerce

Literature

Compulsory Reading

Further Reading

- Dannenberg, H./Zupancic, D. (2010): Spitzenleistungen im Vertrieb. Optimierungen im Vertriebs- und Kundenmanagement. 2. Auflage, Gabler, Wiesbaden.
- Eicher, H. (2006): Die geheimen Spielregeln im Verkauf. Wissen, wie der Kunde tickt. Campus, Frankfurt a. M.
- Herndl, K. (2014): Führen im Vertrieb. So unterstützen Sie Ihre Mitarbeiter direkt und konsequent. 4. Auflage, Gabler, Wiesbaden.
- Limbeck, M. (2016): Das neue Hardselling. Verkaufen heißt verkaufen – So kommen Sie zum Abschluss. 6. Auflage, Gabler, Wiesbaden.
- Schneider, W./Henning, A. (2008): Lexikon Kennzahlen für Marketing und Vertrieb. Das Marketing-Cockpit von A – Z. 2. Auflage, Springer, Berlin/Heidelberg.
- Winkelmann, P. (2012): Marketing und Vertrieb. Fundamente für die Marktorientierte Unternehmensführung. 8. Auflage, Oldenbourg, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Applied Sales II

Course Code: DLBDSEAS02

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

Course Description

The course Applied Sales II builds on the basics taught in the course "Applied Sales I" and broadens and deepens them. First, the tension between marketing and sales is examined in more detail. Based on this, essential backgrounds and central target figures for successful sales management (e.g., customer satisfaction and loyalty as well as the customer life cycle) are derived and operationalized in order to create the basis for efficient and effective customer relationship management. As the process progresses, attention will also be paid to mental processes and consumer behavior in general. In addition, strategies and paths to successful negotiation are deepened and supplemented by convincing communication techniques. The course concludes with a case study in the course of which the students have the opportunity to apply what they have learned in a practice-oriented manner.

Course Outcomes

On successful completion, students will be able to

- understand the interaction and the respective areas of responsibility of marketing and sales.
- reflect on and classify the goals and measures within the framework of the applied sales system.
- assess the relevance of customer satisfaction and retention. In addition, the students will be familiar with the central design elements of CRM.
- reflect on and assess alternative approaches to customer loyalty and relationship management and apply them in business practice.
- understand the meaning of the terms customer life cycle and customer value, and develop approaches to manage them in the sense of the respective sales targets.
- use descriptive presentation techniques in order to convince customers and other sales partners.
- understand the relevance of networking and develop strategies to broaden the contact base.
- develop and evaluate their own market analyses and sales concepts on the basis of practical experience within the framework of the case study.

Contents

8. Case Study in IQ Media Marketing
   - 8.1 The Market Situation
   - 8.2 The Marketing Situation
   - 8.3 IQ Media Marketing and IQ Digital Media Marketing

Literature

Compulsory Reading

Further Reading

- Dannenberg, H./Zupancic, D. (2010): Spitzenleistungen im Vertrieb. Optimierungen im Vertriebs- und Kundenmanagement. 2. Auflage, Gabler, Wiesbaden.
- Eicher, H. (2006): Die geheimen Spielregeln im Verkauf. Wissen, wie der Kunde tickt. Campus, Frankfurt a. M.
- Herndl, K. (2014): Führen im Vertrieb. So unterstützen Sie Ihre Mitarbeiter direkt und konsequent. 4. Auflage, Gabler, Wiesbaden.
- Limbeck, M. (2016): Das neue Hardselling. Verkaufen heißt verkaufen – So kommen Sie zum Abschluss. 6. Auflage, Gabler, Wiesbaden.
- Schneider, W./Henning, A. (2008): Lexikon Kennzahlen für Marketing und Vertrieb. Das Marketing-Cockpit von A – Z. 2. Auflage, Springer, Berlin/Heidelberg.
- Winkelmann, P. (2012): Marketing und Vertrieb. Fundamente für die Marktorientierte Unternehmensführung. 8. Auflage, Oldenbourg, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Supply Chain Management

Module Code: DLBDSESCM

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

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

Module Coordinator

N.N. (Supply Chain Management I) / N.N. (Supply Chain Management II)

Contributing Courses to Module

- Supply Chain Management I (DLBDSESCM01)
- Supply Chain Management II (DLBDSESCM02)

Module Exam Type

Module Exam	Split Exam
	Supply Chain Management I • Study Format "Distance Learning": Module Exam (50) Supply Chain Management II • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

Supply Chain Management I

- Historical and terminological aspects of the SCM concept
- Motives for the creation of cross-company value creation networks
- Design principles and effects of value creation networks
- Logistical core processes and SCM
- Information technology aspects of the SCM concept
- Coordination and collaboration of the network partners
- Industry-specific solutions of the SCM

Supply Chain Management II

- Strategic aspects of SCM
- SCM Practice: Tasks and Activities in the Core Planning Process
- SCM Practice: Tasks and Activities in the Core Process of Procurement
- SCM Practice: Tasks and Activities in the Core Process Production
- SCM Practice: Tasks and Activities in the Core Distribution Process

Learning Outcomes

Supply Chain Management I

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Supply Chain Management II

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the fields of Logistics & Transportation	All Bachelor Programmes in the Transport & Logistics fields

Supply Chain Management I

Course Code: DLBDSESCM01

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

Course Description

SCM proves to be an extremely multi-faceted construct from both a theoretical and a practical point of view. An adequate understanding of the problem dimensions and modes of action of (global) cross-company value creation networks requires a multidimensional approach. It starts by considering logistical processes, with modern process, flow, and network standards forming an important basis for SCM. On the basis of such an approach, students should gain a fundamental understanding of SCM. From the point of view of a holistic approach, it also makes sense to also examine a number of other typical problem areas in addition to the logistical challenges of this concept. This includes IT aspects of SCM (e.g., APS systems), and questions to do with the collaboration and coordination of network partners. This course also considers selected industry specific SCM solutions (ECR or VMI).

Course Outcomes

On successful completion, students will be able to

- explain the importance of cross-company value creation processes.
- understand common concepts for modeling cross-company value creation processes.
- understand dynamic effects in supply chains and can systematize their causes and effects.
- explain important theoretical concepts for describing the characteristics and challenges of cross-company value creation processes.
- explain the approaches and problem categories commonly used in the context of supply chain management.
- understand important reference and/or management models for the concretization of supply chain systems.
- name and detail important roles and tasks in the SCM network.
- deal with the coordination problem of SCM and describe the common solution approaches.

Contents

1. Fundamentals of the Supply Chain Concept
   - 1.1 Terminological and Conceptual Fundamentals
   - 1.2 Supply Chain Typology According to Otto
   - 1.3 Supply Chain Typology According to Bechtel/Jayaram
   - 1.4 Dynamic Aspects of Supply Chains

Literature
Compulsory Reading
Further Reading ▪ Arndt, H. (2018): Supply Chain Management. Optimierung logistischer Prozesse. 7. Auflage, Gabler, Wiesbaden. ▪ Grosche, P. (2012): Konfiguration und Koordination von Wertschöpfungsaktivitäten in internationalen Unternehmen. Eine empirische Untersuchung in der Automobilindustrie. Gabler-Verlag, Wiesbaden. ▪ Heiserich, O.E./Helbig, K./Ullmann, W. (2011): Logistik. Eine praxisorientierte Einführung. 4. Auflage, Gabler-Verlag | Springer Fachmedien, Wiesbaden 2011. ▪ Hertel, J./Zentes, J./Schramm-Klein, H. (2011): Supply-Chain-Management und Warenwirtschaftssysteme im Handel. 2. Auflage, Springer Verlag, Heidelberg. ▪ Hungenberg, H. (2014): Strategisches Management in Unternehmen. Ziele-Prozesse-Verfahren. 8. Auflage, Wiesbaden. ▪ Pfohl, H. C. (2010): Logistiksysteme. Betriebswirtschaftliche Grundlagen. 8 Auflage, Springer, Berlin. ▪ Schulte, C. (2013): Logistik. Wege zur Optimierung der Supply Chain. 6. Auflage, Vahlen, München. ▪ Werner, H. (2013): Supply Chain Management. Grundlagen, Strategien, Instrumente und Controlling. 5. Auflage, Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Supply Chain Management II

Course Code: DLBDSESCM02

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

Course Description

From the perspective of strategic management research and practice, the activities covered by the term SCM are closely related to efforts to build and/or maintain a stable operational competitive advantage. A fundamental discussion of this relationship forms the starting point for the course. On this basis, a differentiated analysis of strategy-relevant activities and instruments in the Plan, Source, Make, Deliver, and Return process categories is then carried out using the SCOR model. Special attention is given to the practice-relevant areas of SCM, e.g., order-promising (plan), supplier-relation-management (source), postponement (make), and the ECR-concept (deliver).

Course Outcomes

On successful completion, students will be able to

- systematically explain the strategic relevance of enterprise-wide value creation processes.
- understand the most important tasks and problems in the SCM core process planning.
- systematize the elements and interrelationships in the CPFR model in a differentiated way.
- be familiar with the characteristics and peculiarities of contract logistics.
- understand the most important tasks and problems in the SCM core process procurement.
- explain central elements and characteristics of a procurement strategy.
- understand the most important tasks and problems in the SCM core process production.
- explain central elements and characteristics of a modern production strategy.
- understand the most important tasks and problems in the SCM core process distribution.
- explain central elements and characteristics of the so-called ECR concept.

Contents

1. Strategic Aspects of SCM
   - 1.1 Strategic Thinking and Action: General Information
   - 1.2 Competition Focus and SCM
   - 1.3 Competition Location and SCM
   - 1.4 Competition Rules and SCM

2. SCM Practice: Core Process Planning
   - 2.1 General Preliminary Considerations
   - 2.2 Collaborative Planning, Forecasting, and Replenishment
   - 2.3 Order Promoting
   - 2.4 Kanban
   - 2.5 Integration of X-PL Logistics Service Providers

3. SCM Practice: Core Process Procurement
   - 3.1 General Preliminary Considerations
   - 3.2 Production Synchronous Procurement
   - 3.3 Sourcing Concepts
   - 3.4 Supplier Relations Management

4. SCM Practice: Core Process Production
   - 4.1 Selected Aspects of the Problem Background
   - 4.2 Collaborative Engineering
   - 4.3 Postponement Strategies
   - 4.4 Value Added Partnership

5. SCM Practice: Core Process Distribution
   - 5.1 Basic Information on the Distribution Problem
   - 5.2 Efficient Consumer Response (ECR)
   - 5.3 Consignment Warehouse

Literature
Compulsory Reading
Further Reading ▪ Arndt, H. (2018): Supply Chain Management. Optimierung logistischer Prozesse. 7. Auflage, Gabler, Wiesbaden. ▪ Grosche, P. (2012): Konfiguration und Koordination von Wertschöpfungsaktivitäten in internationalen Unternehmen. Eine empirische Untersuchung in der Automobilindustrie. Gabler-Verlag, Wiesbaden. ▪ Heiserich, O.E./Helbig, K./Ullmann, W. (2011): Logistik. Eine praxisorientierte Einführung. 4. Auflage, Gabler-Verlag | Springer Fachmedien, Wiesbaden 2011. ▪ Hertel, J./Zentes, J./Schramm-Klein, H. (2011): Supply-Chain-Management und Warenwirtschaftssysteme im Handel. 2. Auflage, Springer Verlag, Heidelberg. ▪ Hungenberg, H. (2014): Strategisches Management in Unternehmen. Ziele-Prozesse-Verfahren. 8. Auflage, Wiesbaden. ▪ Pfohl, H. C. (2010): Logistiksysteme. Betriebswirtschaftliche Grundlagen. 8 Auflage, Springer, Berlin. ▪ Schulte, C. (2013): Logistik. Wege zur Optimierung der Supply Chain. 6. Auflage, Vahlen, München. ▪ Werner, H. (2013): Supply Chain Management. Grundlagen, Strategien, Instrumente und Controlling. 5. Auflage, Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSESCM02

Financial Services Management

Module Code: DLBDSEFSM

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

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

Module Coordinator

N.N. (Financial Services Management I) / N.N. (Financial Services Management II)

Contributing Courses to Module

- Financial Services Management I (DLBDSEFSM01)
- Financial Services Management II (DLBDSEFSM02)

Module Exam Type

Module Exam	Split Exam
	Financial Services Management I • Study Format "Distance Learning": Module Exam (50) Financial Services Management II • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

Financial Services Management I

- Financial Markets and Financial Intermediaries
- Financial Intermediation in Germany
- Financial Services
- Debt Financing Through Financial Intermediaries
- Equity Financing Through Financial Intermediaries

Financial Services Management II

- Fundamentals of the Monetary and Asset Situation
- Investment in Money
- Investment in Tangible Assets
- Investment Funds and Certificates
- Insurance Financial Services

Learning Outcomes

Financial Services Management I

On successful completion, students will be able to

- know the role of a financial service provider as a financier as well as how individual markets function in the financing sector.
- understand the basic relationships between the different financial services and their (supervisory) legal frameworks.
- evaluate the potential influence of the financial services sector on the real economy.
- familiarize themselves with the financing services offered both for external financing and for self-financing.
- assess the importance of financial services in the form of debt and equity financing in the short, medium, and long term.

Financial Services Management II

On successful completion, students will be able to

- systematize the different possibilities for the investment of financial surpluses.
- with the help of knowledge gained regarding conflicts involved in making financial investments, apply different aspects of investment decision-making to financial instruments.
- assess the various forms of investment in order of their safety.
- analyze the various forms of investment in terms of risk and return.
- understand that investment funds, certificates, and derivatives are modern products of financial service providers, which bring high returns and sometimes high risk.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the fields of Finance & Tax Accounting	All Bachelor Programmes in the Business & Management fields

Financial Services Management I

Course Code: DLBDSEFSM01

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

Course Description

The course explains the origin and constitution of the financial market. As a result of the imperfection of the financial market, the necessity of financial intermediaries is theoretically derived, which leads to the thesis of disintermediation. Since the German financial market is determined by regulations and supervision, the legal framework is discussed. The financial services of banks and other specialized financial intermediaries are presented. The main forms of debt financing through financial intermediaries are presented as well as financing with equity capital.

Course Outcomes

On successful completion, students will be able to

- know the role of a financial service provider as a financier as well as how individual markets function in the financing sector.
- understand the basic relationships between the different financial services and their (supervisory) legal frameworks.
- evaluate the potential influence of the financial services sector on the real economy.
- familiarize themselves with the financing services offered both for external financing and for self-financing.
- assess the importance of financial services in the form of debt and equity financing in the short, medium, and long term.

Contents

1. Financial Markets and Financial Intermediaries
   - 1.1 Origin and Basic Problems of the Financial Market
   - 1.2 Appearances and Functions of Financial Intermediaries
   - 1.3 The Thesis of Disintermediation in Finance
2. Financial Intermediation in Germany
   - 2.1 The Banking System in Germany
   - 2.2 Capital Management Companies and Insurance Companies
   - 2.3 Regulations and Supervision

3. Financial Services
   - 3.1 Financing Needs
   - 3.2 The Range of Financial Services
   - 3.3 Lending and Collateralization

4. Debt Financing Through Financial Intermediaries
   - 4.1 Short-Term Loans as a Financing Service
   - 4.2 Medium and Long-Term Loans as Financial Services
   - 4.3 Credit Substitutes

5. Equity Financing Through Financial Intermediaries
   - 5.1 Equity Financing Through Capital Participation and Venture Financing Companies
   - 5.2 Services in Connection With Issue Financing

Literature

Compulsory Reading

Further Reading

- Bitz, M./Stark, G. (2008): Finanzdienstleistungen. 8. Auflage, Oldenbourg, München/Wien.
- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10. Auflage, McGraw-Hill, London.
- Copeland, T. E./Weston, J. F./Shastri, K. (2008): Finanzierungstheorie und Unternehmenspolitik. 4. Auflage, Pearson, München.
- Hartmann-Wendels, T./Pfingsten, A./Weber. M. (2006): Bankbetriebslehre. 4. Auflage, Springer, Berlin.
- Perridon, L./Steiner, M./Rathgeber, A. W. (2009): Finanzwirtschaft der Unternehmung. 15. Auflage, Vahlen, München.
- Wöhe, G. et al. (2009): Grundzüge der Unternehmensfinanzierung. 10. Auflage, Vahlen, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Financial Services Management II

Course Code: DLBDSEFSM02

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

Course Description

In this course, the different possibilities of investing financial surpluses are systematized. The conflicting relationship between the risks, returns, and liquidity of a financial investment are presented, and the different aspects of decision-making for investment in one of the financial instruments are shown. The various forms of investment (monetary values, tangible assets) are presented in the order of their security. The functions that insurance companies perform as financial service providers complete the picture. The different forms of life insurance and their role in old-age provision are presented.

Course Outcomes

On successful completion, students will be able to

- systematize the different possibilities for the investment of financial surpluses.
- with the help of knowledge gained regarding conflicts involved in making financial investments, apply different aspects of investment decision-making to financial instruments.
- assess the various forms of investment in order of their safety.
- analyze the various forms of investment in terms of risk and return.
- understand that investment funds, certificates, and derivatives are modern products of financial service providers, which bring high returns and sometimes high risk.

Contents

1. Basic Information on Investing Money and Assets
   - 1.1 Basic Concepts of Money and Asset Investment
   - 1.2 Framework Conditions for Decisions on Plants
   - 1.3 Investment Products
2. Investment in Money
   - 2.1 Investment in Accounts
   - 2.2 Savings Bonds
   - 2.3 Fixed-Interest Securities

3. Investment in Tangible Assets
   - 3.1 Shares
   - 3.2 Stock Exchange Trading
   - 3.3 Investment in Real Estate

4. Investment Funds and Certificates
   - 4.1 Mutual Funds
   - 4.2 Fund of Funds and Hedge Funds
   - 4.3 Derivatives

5. Insurance Financial Services
   - 5.1 Fundamentals of the Insurance Industry
   - 5.2 The Life Insurances

Literature

Compulsory Reading

Further Reading

- Bitz, M./Stark, G. (2008): Finanzdienstleistungen. 8. Auflage, Oldenbourg, München/Wien.
- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10. Auflage, McGraw-Hill, London.
- Copeland, T. E./Weston, J. F./Shastri, K. (2008): Finanzierungstheorie und Unternehmenspolitik. 4. Auflage, Pearson, München.
- Hartmann-Wendels, T./Pfingsten, A./Weber. M. (2006): Bankbetriebslehre. 4. Auflage, Springer, Berlin.
- Perridon, L./Steiner, M./Rathgeber, A. W. (2009): Finanzwirtschaft der Unternehmung. 15. Auflage, Vahlen, München.
- Wöhe, G. et al. (2009): Grundzüge der Unternehmensfinanzierung. 10. Auflage, Vahlen, München.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☑ Exam Template	

Smart Factory

Module Code: DLBDSESF

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

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

Module Coordinator

N.N. (Smart Factory I) / Prof. Dr. Christian Magnus (Smart Factory II)

Contributing Courses to Module

- Smart Factory I (DLBDSESF01)
- Smart Factory II (DLBDSESF02)

Module Exam Type

Module Exam	Split Exam
	Smart Factory I • Study Format "Distance Learning": Exam, 90 Minutes Smart Factory II • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents

Smart Factory I

- Motivation and Definition of Terms
- Development of Automation
- Technological Basics and Standards
- Basic concepts of a Smart Factory
- Reference Architectures
- Smart Factory Engineering
- Safety and Security

Smart Factory II

A catalogue with the currently provided tasks is provided on the online platform of the module. It provides the content basis of the module and can be supplemented or updated by the seminar leader.

Learning Outcomes

Smart Factory I

On successful completion, students will be able to

- understand the term Smart Factory in the context of Industry 4.0.
- be able to trace the development of automation to a fully autonomous, non-centrally organized production plant.
- understand the basic technologies and standards used to design and operate a Smart Factory.
- understand the essential concepts of a Smart Factory.
- identify and differentiate between the individual elements of a Smart Factory using different reference architectures.
- understand the special engineering challenges in the Smart Energy context.
- understand the special safety risks of digitized and networked production plants and assign concrete recommendations for action.

Smart Factory II

On successful completion, students will be able to

- have a deeper understanding of the technologies and standards in the context of Smart Factory.
- apply technologies in the context of Smart Factory to a simple practical example.
- design a hardware or software prototype for a selected task.
- document, design, and develop activities in the form of a project report.

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

Smart Factory I

Course Code: DLBDSESF01

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

Course Description

In this course, students will gain a deeper insight into the networking and digitization of production facilities by examining a Smart Factory. For this purpose, they will be familiarized with the basic goals of a Smart Factory in the context of the research complex Industry 4.0. After a brief introduction to the history of automation, students will learn the technical basics and standards required to design and operate a Smart Factory. Building on this, they will learn how these individual technologies are used to implement the central concepts of a Smart Factory. In order to understand which components a Smart Factory consists of, different reference architectures are presented and compared. The course concludes with the special engineering challenges of an autonomously acting and decentralized production plant. Above all, this includes IT security, which is particularly relevant due to the digital networking of production facilities and products.

Course Outcomes

On successful completion, students will be able to

- understand the term Smart Factory in the context of Industry 4.0.
- be able to trace the development of automation to a fully autonomous, non-centrally organized production plant.
- understand the basic technologies and standards used to design and operate a Smart Factory.
- understand the essential concepts of a Smart Factory.
- identify and differentiate between the individual elements of a Smart Factory using different reference architectures.
- understand the special engineering challenges in the Smart Energy context.
- understand the special safety risks of digitized and networked production plants and assign concrete recommendations for action.

Contents

1. Motivation and Definition of Terms
   - 1.1 Goals of Smart Factory
   - 1.2 Internet of Things
   - 1.3 Cyber-Physical Systems
   - 1.4 Cyber-Physical Production Systems
   - 1.5 Smart Factory as a Cyber-Physical (Production) System

2. Development of Automation
   - 2.1 Automation Pyramid
   - 2.2 Networked, Decentralized Organization of Production
   - 2.3 Future Challenges

3. Technological Basics and Standards
   - 3.1 Identification of Physical Objects
   - 3.2 Formal Description Languages and Ontologies
   - 3.3 Digital Object Memory
   - 3.4 Physical Situation Recognition
   - 3.5 (Partially) Autonomous Action and Cooperation
   - 3.6 Human-Machine Interaction
   - 3.7 Machine to Machine Communication

4. Basic Concepts of a Smart Factory
   - 4.1 Order-Controlled Production
   - 4.2 Bundling of Machine and Production Data
   - 4.3 Supporting People in Production
   - 4.4 Intelligent Products and Resources
   - 4.5 Smart Services

5. Reference Architectures
   - 5.1 Purpose and Properties of Reference Architectures
   - 5.2 Overview of Standardization Initiatives
   - 5.3 CyProS Reference Architecture
   - 5.4 RAMI 4.0 (DIN SPEC 91345)

6. Smart Factory Engineering
   - 6.1 Classification of Different Engineering Tools
   - 6.2 Virtual Engineering
   - 6.3 User-Centered Design
   - 6.4 Requirements Engineering
   - 6.5 Modelling
   - 6.6 Integration of Classic and Smart Components

Literature
Compulsory Reading
Further Reading ▪ Bangemann, T. et al. (2016): Integration of Classical Components into Industrial Cyber–Physical Systems. In: Proceedings of the IEEE, 104. Jg., Heft 5, S. 947–959. DOI: 10.1109/JPROC.2015.2510981. ▪ Bauernhansl, T./Hompel, M. ten/Vogel-Heuser, B. (Hrsg.) (2014): Industrie 4.0 in Produktion, Automatisierung und Logistik. Springer, Berlin. ▪ Bundesministerium für Wirtschaft und Energie (Hrsg.) (2016): IT-Sicherheit für die Industrie 4.0. Produktion, Produkte, Dienste von morgen im Zeichen globalisierter Wertschöpfungsketten. Berlin. ▪ Geisberger, E./Broy, M. (Hrsg.) (2012): agendaCPS. Integrierte Forschungsagenda Cyber-Physical Systems. Springer, Berlin/Heidelberg. ▪ Harrison, R./Vera, D.; Ahmad, B. (2016): Engineering Methods and Tools for Cyber–Physical Automation Systems. In: Proceedings of the IEEE, 104. Jg., Heft 5, S. 973–985. DOI: 10.1109/JPROC.2015.2510665. ▪ Haupert, J. (2013): DOMeMan: Repräsentation, Verwaltung und Nutzung von digitalen Objektgedächtnissen. Akademische Verlagsgesellschaft AKA, Berlin. ▪ VDMA & Partner (2016): Leitfaden Industrie 4.0 Security. Handlungsempfehlungen für den Mittelstand. VDMA Verlag, Frankfurt a. M.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Smart Factory II

Course Code: DLBDSESF02

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

Course Description

In this course, students select a concrete task from the catalog of topics provided in consultation with the seminar leader. They will work on the task in a prototyping environment suited to the task, which can be either a hardware (e.g., prototyping boards) or software (e.g., technology-specific development environments) environment. To complete the task, students apply the concepts, methods, and tools taught in the Smart Factory I course. They document their results with a project report.

Course Outcomes

On successful completion, students will be able to

- have a deeper understanding of the technologies and standards in the context of Smart Factory.
- apply technologies in the context of Smart Factory to a simple practical example.
- design a hardware or software prototype for a selected task.
- document, design, and develop activities in the form of a project report.

Contents

- A catalogue with the currently provided tasks is provided on the online platform of the module. It provides the content basis of the module and can be supplemented or updated by the seminar leader.

Literature

Compulsory Reading

Further Reading

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Project Report

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSESF02

Automation and Robotics

Module Code: DLBDSEAR

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	▪ none ▪ DLBDSEAR01	BA	10	300 h

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

Module Coordinator

Prof. Dr. Mario Boßlau (Production Engineering) / N.N. (Automation and Robotics)

Contributing Courses to Module

- Production Engineering (DLBDSEAR01)
- Automation and Robotics (DLBDSEAR02)

Module Exam Type

Module Exam	Split Exam
	Production Engineering • Study Format "Distance Learning": Exam, 90 Minutes (50) Automation and Robotics • Study Format "Distance Learning": Module Exam (50)

Weight of Module

see curriculum

Module Contents

Production Engineering

- Introduction to Manufacturing Technology
- Main Production Groups According to DIN 8580
- Additive Manufacturing Processes
- Rapid Prototyping
- Rapid Tooling
- Direct/Rapid Manufacturing
- Cyber-Physical Production Plants

Automation and Robotics

- Basics of Automation
- Fundamentals of Measurement Technology
- Sensors
- Basics of Control Engineering
- Basics of Control Technology
- Introduction to Robotics
- Kinematics of a Robot

Learning Outcomes

Production Engineering

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Automation and Robotics

On successful completion, students will be able to

- understand the basic aspects of automation.
- understand the different sizes and units in measurement technology.
- differentiate between different measurement methods.
- understand the basic structure of measuring equipment.
- select a suitable sensor based on various criteria.
- understand the elements of control systems.
- describe the behavior of control systems in the time and frequency domain.
- understand the basic principles of control technology.
- convert between different number systems and apply Boolean algebra.
- understand the structure of switching networks, plants, and storages.
- understand important elements of control systems such as signal generators and power amplifiers.
- design simple programmable logic controllers.
- understand the basic structure of industrial robots.
- calculate different movements and positions of jointed-arm robots.

Links to other Modules within the Study Program	**Links to other Study Programs of IUBH**
This module is similar to other modules in the field of Engineering	All Bachelor Programmes in the IT & Technology fields

Production Engineering

Course Code: DLBDSEAR01

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

Course Description

The aim of the course is to provide students with an overview of the processes that have influenced and still influence production processes through technological developments under the generic term Industry 4.0, based on traditional, standardized manufacturing techniques. These include, in particular, technological advances in additive manufacturing processes that enable applications such as rapid prototyping, rapid tooling, and direct manufacturing. Finally, the course deals with the consequences of the digitalization and networking of production facilities and their elements in the sense of a cyber-physical system.

Course Outcomes

On successful completion, students will be able to

- understand the basic concepts and interrelationships of production engineering.
- understand current changes in manufacturing technology due to technologies such as additive manufacturing and megatrends such as cyber physical systems.
- assign different manufacturing processes to the main manufacturing groups according to DIN 8580.
- understand the basic principle of additive manufacturing processes.
- distinguish between different additive manufacturing processes.
- understand the terms Rapid Prototyping, Rapid Tooling, and Direct Manufacturing and name individual processes and application examples.
- understand the elements and properties of cyber-physical production plants.

Contents

1. Introduction to Manufacturing Technology
   - 1.1 Basic Terms and Contexts in Manufacturing Theory
   - 1.2 Historical Development of Production
   - 1.3 The Discussion About the Long Tail

2. Main Production Groups According to DIN 8580
   - 2.1 Archetypes
   - 2.2 Reshaping
   - 2.3 Cutting (Cutting, Machining, Ablation)
   - 2.4 Joining
   - 2.5 Coating
   - 2.6 Substance Property Changes

3. Additive Manufacturing Processes
   - 3.1 Basic Principles and Legal Aspects
   - 3.2 Stereolithography (STL)
   - 3.3 Selective Laser Sintering and Selective Beam Melting With Laser or Electron Beam
   - 3.4 Fused Deposition Modeling (FDM)
   - 3.5 Multi-Jet Modeling (MJM) and Poly-Jet Process (PJM)
   - 3.6 3D Printing Process (3DP)
   - 3.7 Laminating Processes
   - 3.8 Mask Sintering

4. Rapid Prototyping
   - 4.1 Definition
   - 4.2 Strategic and Operational Aspects
   - 4.3 Application Areas and Examples

5. Rapid Tooling
   - 5.1 Definition, Strategic, and Operational Aspects
   - 5.2 Indirect and Direct Procedures

6. Direct/Rapid Manufacturing
   - 6.1 Potentials and Requirements for Procedures
   - 6.2 Implementation, Application Areas, and Examples

7. Cyber-Physical Production Plants
   - 7.1 Derivation of the Terms Industry 4.0 and Cyber-Physical Systems
   - 7.2 Megatrend Cyber Physical Systems (CPS)
   - 7.3 Definition Cyber-Physical Production Plant
   - 7.4 Effects on Planning and Operation of Production Facilities
   - 7.5 Dynamic Reconfiguration and Migration of Production Facilities

Literature
Compulsory Reading
Further Reading ▪ Anderson, C. (2012): Makers. The new industrial revolution. Crown Business, New York. ▪ Bauernhansl, Thomas/Hompel, M. ten/Vogel-Heuser, B. (Hrsg.) (2014): Industrie 4.0 in Produktion, Automatisierung und Logistik. Anwendung – Technologien – Migration. Springer, Wiesbaden. ▪ Gebhardt, A. (2012): Understanding Additive Manufacturing. Rapid Prototyping – Rapid Tooling – Rapid Manufacturing. Hanser, München/Cincinnati. ▪ Lachmayer, R./Lippert, R. B./Fahlbusch, T. (Hrsg.) (2016): 3D-Druck beleuchtet. Additive Manufacturing auf dem Weg in die Anwendung. Springer, Berlin/Heidelberg. ▪ Wittenstein, M. et al. (Hrsg.) (2015): Intelligente Vernetzung in der Fabrik. Industrie 4.0. Umsetzungsbeispiele für die Praxis. Fraunhofer Verlag, Stuttgart.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Automation and Robotics

Course Code: DLBDSEAR02

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSEAR01

Course Description

The aim of the course is to provide students with an insight into measurement, control, and regulation technology and convey the basics of robotics. Students will be taught which methods can be used to determine certain measured variables and how measurement errors are dealt with. Based on these fundamentals, various sensors will be presented and students will be able to select suitable sensors based on predefined criteria. The course also introduces students to the basics of control engineering. The different ways of describing the structure and behaviour of control systems are illustrated to the students. The basics of control engineering are also taught. The students receive a short introduction to binary number systems and Boolean algebra, and deal with various basal circuit and control elements. Finally, students will gain an insight into robotics with a focus on industrial robots. In this context, the students learn the description and calculation of positions and movements of individual limbs of a robot arm.

Course Outcomes

On successful completion, students will be able to

- understand the basic aspects of automation.
- understand the different sizes and units in measurement technology.
- differentiate between different measurement methods.
- understand the basic structure of measuring equipment.
- select a suitable sensor based on various criteria.
- understand the elements of control systems.
- describe the behavior of control systems in the time and frequency domain.
- understand the basic principles of control technology.
- convert between different number systems and apply Boolean algebra.
- understand the structure of switching networks, plants, and storages.
- understand important elements of control systems such as signal generators and power amplifiers.
- design simple programmable logic controllers.
- understand the basic structure of industrial robots.
- calculate different movements and positions of jointed-arm robots.

Contents

5. Basics of Control Technology
   - 5.1 Basic Principle and Elements of Control Systems
   - 5.2 Numerical Representations
   - 5.3 Boolean Algebra
   - 5.4 Switching Networks, Plants, and Storage Facilities
   - 5.5 Signal Generators and Power Amplifiers
   - 5.6 Programmable Logic Controllers
   - 5.7 Connection-Programmed Controls

6. Introduction to Robotics
   - 6.1 Terms and Classification
   - 6.2 Basic Elements
   - 6.3 Classification of Robots

7. Kinematics of a Robot
   - 7.1 Coordinate Systems and Reference Points
   - 7.2 Rotations
   - 7.3 Forward and Reverse Transformations
   - 7.4 Denavit-Hartenberg Transformation

Literature

Compulsory Reading

Further Reading

- Heinrich, B./Linke, P./Glöckler, M. (2015): Grundlagen Automatisierung. Springer, Wiesbaden.
- Hesse, S./Malisa, V. (Hrsg.) (2016): Taschenbuch Robotik – Montage – Handhabung. 2. Auflage, Carl Hanser Verlag, München.
- Jazar, R. N. (2010): Theory of Applied Robotics. 2. Auflage, Springer US, Boston (MA).
- Karaali, C. (2013): Grundlagen der Steuerungstechnik. Springer, Wiesbaden.
- Parthier, R. (2011): Messtechnik. Grundlagen und Anwendungen der elektrischen Messtechnik für alle technischen Fachrichtungen und Wirtschaftsingenieure. 6. Auflage, Vieweg & Teubner, Wiesbaden.
- Tietze, U./Schenk, C./Gamm, E. (2016): Halbleiter-Schaltungstechnik. 15. Auflage, Springer, Berlin.
- Zacher, S./Reuter, M. (2014): Regelungstechnik für Ingenieure. Springer, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Module Exam

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBDSEAR02

Autonomous Driving

Module Code: DLBDSEAD

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	none	BA	10	150 h

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

Module Coordinator

N.N. (Self-Driving Vehicles) / N.N. (Seminar: Current Topics and Trends in Self-Driving Technology)

Contributing Courses to Module

- Self-Driving Vehicles (DLBDSEAD01)
- Seminar: Current Topics and Trends in Self-Driving Technology (DLBDSEAD02)

Module Exam Type

Module Exam	Split Exam
	Self-Driving Vehicles • Study Format "Distance Learning": Exam, 90 Minutes (50) Seminar: Current Topics and Trends in Self-Driving Technology • Study Format "Distance Learning": Written Assessment: Research Essay (50)

Weight of Module

see curriculum

Module Contents

Self-Driving Vehicles

- Safety standards
- Sensor fusion
- Computer vision
- Localization & motion
- Motion planning

Seminar: Current Topics and Trends in Self-Driving Technology

The seminar covers current topics of autonomous vehicles. The choice of topics can include (but are not limited to) recent technical advances as well as philosophical issues or implications for society, law, or relevant industries.

Learning Outcomes

Self-Driving Vehicles

On successful completion, students will be able to

- cite relevant safety standards.
- grasp the concepts of sensors and sensor fusion.
- apply computer vision techniques to detect features.
- evaluate images in terms of semantic segmentation.
- understand motion models and localization approaches.
- utilize motion planning techniques.

Seminar: Current Topics and Trends in Self-Driving Technology

On successful completion, students will be able to

- transfer theoretical knowledge and methods to new domains.
- understand recent developments in self-driving vehicles.
- create new insights based on detailed studies of current research and technology.

Links to other Modules within the Study Program	Links to other Study Programs of IUBH
This module is similar to other modules in the field of Engineering	All Bachelor Programmes in the IT & Technology fields

Self-Driving Vehicles

Course Code: DLBDSEAD01

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

Course Description

This course focuses on the foundations of autonomous vehicles and starts with a detailed introduction to relevant safety standards in terms of functional and IT security.This course continues with a presentation of the concept of sensor fusion and discusses relevant aspects of computer vision techniques such as feature detection, calibration, and semantic segmentation.A large part of the course concerns localization and motion planning. Relevant motion models are introduced and localization techniques such as odometry, triangulation, and satellite-based systems are discussed in detail, along with path planning, motion prediction, and trajectory generation.

Course Outcomes

On successful completion, students will be able to

- cite relevant safety standards.
- grasp the concepts of sensors and sensor fusion.
- apply computer vision techniques to detect features.
- evaluate images in terms of semantic segmentation.
- understand motion models and localization approaches.
- utilize motion planning techniques.

Contents

1. Sensors
   - 1.1 Physical principles of sensors
   - 1.2 Types of sensors
   - 1.3 Sensor calibaration
   - 1.4 Application scenarios
2. Sensor Fusion
   - 2.1 Elaborating data from sensors
   - 2.2 Kalman filter
   - 2.3 Object tracking

3. Computer Vision
   - 3.1 Pixels and filters
   - 3.2 Feature detection
   - 3.3 Distortions and calibration
   - 3.4 Semantic segmentation

4. Localization & Motion
   - 4.1 Motion models
   - 4.2 Odometry
   - 4.3 Triangulation
   - 4.4 Satellite-based localization

5. Motion planning
   - 5.1 Path planning
   - 5.2 Motion prediction
   - 5.3 Trajectory generation

6. Safety Standards
   - 6.1 Functional Safety
   - 6.2 IT Security Standards
   - 6.3 Safety development approaches

Literature

Compulsory Reading

Further Reading

- Ben-Ari, M./Mondada, F. (2018): Elements of robotics. Springer, Cham.
- European Union. (2001).:Directive 2001/95/EG. (URL: https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32001L0095 [Retrieved: 28.02.2020])
- Fisher, R. B., et al. (2016): Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- International Electrotechnical Commission. (2015): IEC 61508. (URL: https://www.iec.ch/functionalsafety/ [Retrieved: 28.02.2020])
- International Organization for Standardization. (2009): ISO 15408. (URL: https://www.iso.org/standard/50341.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 25119. (URL: https://www.iso.org/standard/69026.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 26262. (URL: https://www.iso.org/standard/68383.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (n.d.): ISO 21434. (URL: https://www.iso.org/standard/70918.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO/IEC 27001. (URL: https://www.iso.org/isoiec-27001-information-security.html [Retrieved: 28.02.2020])
- Rausand, M. (2014): Reliability of safety-critical systems: Theory and applications. Wiley, Hoboken, NJ.
- Smith, D. J./Simpson, K. (2016): The safety critical systems handbook. 4th ed., Elsevier, Oxford.
- Smith, D. J. (2017): Reliability, maintainability and risk. 9th ed., Elsevier, Oxford.
- Society of Automobile Engineers International. (2012): SAE J3061. (URL: https://www.sae.org/standards/content/j3061/ [Retrieved: 28.02.2020])
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Wang, P. K.-C. (2015): Visibility-based optimal path and motion planning (vol. 568). Springer, Cham.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☑ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

Seminar: Current Topics and Trends in Self-Driving Technology

Course Code: DLBDSEAD02

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

Course Description

This courses focuses on recent developments in the field of self-driving vehicles. Following the course Self-Driving Vehicles (DLBDSEAD01), in this course students will focus on a particular topic in the context of autonomous driving, applying the knowledge they have obtained in the first course.Finally, a research essay will be written.

Course Outcomes

On successful completion, students will be able to

- transfer theoretical knowledge and methods to new domains.
- understand recent developments in self-driving vehicles.
- create new insights based on detailed studies of current research and technology.

Contents

- The seminar covers current topics of autonomous vehicles. The choice of topics can include (but are not limited to) recent technical advances as well as philosophical issues or implications for society, law, or relevant industries.

Literature

Compulsory Reading

Further Reading

- Ben-Ari, M./Mondada, F. (2018): Elements of robotics. Springer, Cham.
- European Union. (2001).:Directive 2001/95/EG. (URL: https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32001L0095 [Retrieved: 28.02.2020])
- Fisher, R. B., et al. (2016): Dictionary of computer vision and image processing. John Wiley & Sons, Chichester.
- International Electrotechnical Commission. (2015): IEC 61508. (URL: https://www.iec.ch/functionalsafety/ [Retrieved: 28.02.2020])
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- International Organization for Standardization. (2018): ISO 25119. (URL: https://www.iso.org/standard/69026.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO 26262. (URL: https://www.iso.org/standard/68383.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (n.d.): ISO 21434. (URL: https://www.iso.org/standard/70918.html [Retrieved: 28.02.2020])
- International Organization for Standardization. (2018): ISO/IEC 27001. (URL: https://www.iso.org/isoiec-27001-information-security.html [Retrieved: 28.02.2020])
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- Rausand, M. (2014): Reliability of safety-critical systems: Theory and applications. Wiley, Hoboken, NJ.
- Smith, D. J./Simpson, K. (2016): The safety critical systems handbook. 4th ed., Elsevier, Oxford.
- Smith, D. J. (2017): Reliability, maintainability and risk. 9th ed., Elsevier, Oxford.
- Society of Automobile Engineers International. (2012): SAE J3061. (URL: https://www.sae.org/standards/content/j3061/ [Retrieved: 28.02.2020])
- Szelski, R. (2011): Computer vision: Algorithms and applications. 2nd ed., Springer VS, Wiesbaden.
- Wang, P. K.-C. (2015): Visibility-based optimal path and motion planning (vol. 568). Springer, Cham.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Seminar

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Written Assessment: Research Essay

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
120 h	0 h	30 h	0 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☑ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLBDSEAD02

Foreign Language Italian

Module Code: DLFLI

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

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

Module Coordinator

N.N. (Foreign Language Italian)

Contributing Courses to Module

- Foreign Language Italian (DLFLI01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 180 Minutes	

Weight of Module

see curriculum

Module Contents

- Depending on the CEFR classification, students are qualified to
  - understand and use familiar everyday expressions and very simple sentences aimed at satisfying concrete needs. They can introduce themselves and others and ask other people questions about themselves – e.g. where they live, who they know, or what things they have – and answer questions of this kind. They can communicate in a simple way if the other party speaks slowly and clearly and is willing to help. (Level A1)**
  - understand sentences and frequently used expressions related to areas of most immediate relevance (e.g., personal and family information, shopping, work, and local area). They can communicate in simple, routine situations that involve a simple and direct exchange of information about familiar and common things. They can use simple language to describe their own background and education, their immediate environment, and things related to immediate needs. (Level A2)**
  - understand the main points when clear standard language is used and when it comes to familiar matters from work, school, and leisure, etc. They can cope with most situations encountered when traveling in an area where the language is spoken. They can express themselves simply and coherently on familiar topics and personal areas of interest. They can report on experiences and events, describe dreams, hopes and goals, and give brief reasons or explanations for their plans and views. (Level B1) **
  - understand the main contents of complex texts on concrete and abstract topics and, in their own field, also technical discussions. They can communicate so spontaneously and fluently that a normal conversation with native speakers is possible without much effort on both sides. They can express themselves clearly and in detail on a wide range of topics, explain a point of view on a topical issue, and indicate the advantages and disadvantages of different options. (Level B2) **
  - understand a wide range of demanding, longer texts and grasp implicit meanings. They can express themselves spontaneously and fluently without often having to search for words. They can use the language effectively and flexibly in social and professional life or in training and studies. They can express themselves in a clear, structured, and detailed manner on complex issues, using various means of text linking appropriately. (Level C1)***
- Grammar:
  - Level A1 – includes present and past tenses, sentence construction, and prepositions, etc.
  - Level A2 – includes historical tenses, differences in times of the past, imperative, subordinate clauses, and pronouns (dative, accusative)
  - Level B1 - among others, an introduction of the pluperfect, conjunctions, the passive, adverbs, adjectives (difference), and the future tense
  - Level B2 - includes verb constructions, conditional sentences, and indirect speech, etc.
  - Level C1 - Exercises to consolidate and repeat what has been learned
- **Source:
  http://www.coe.int/t/dg4/linguistic/Cadre1_en.asp
  and
  http://www.coe.int/t/dg4/linguistic/Source/Framework_EN.pdf
- *** Source:
  http://www.goethe.de/z/50/commeuro/303.htm

Learning Outcomes **Foreign Language Italian** On successful completion, students will be able to	
Links to other Modules within the Study Program This module is similar to other modules in the field of Languages	**Links to other Study Programs of IUBH** All Distance Learning Bachelor Programmes

Foreign Language Italian

Course Code: DLFLI01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		10	none

Course Description

The qualification goals correspond to level A1-C1 according to the criteria of the Common European Framework of Reference for Languages (CEFR).A1-A2: The basic use of Italian as a foreign language is taught and practiced on the basis of everyday topics and basic grammatical structures.B1: With an expansion of grammatical knowledge and skills and the development of vocabulary in fields such as everyday working life, culture, business, and current events, the independent use of Italian as a foreign language is taught and practiced.B2: The independent use of Italian as a foreign language is taught and practiced by broadening and deepening previous grammatical knowledge and skills and expanding vocabulary in fields such as everyday work, culture, business, professional specializations, and current events.C1: The independent use of the foreign language Italian is taught and practiced with an extension and deepening of the previous grammatical knowledge and skills and the expansion of the vocabulary in fields such as everyday working life, culture, economics, professional specializations, and current events.Course Objectives and Outcome:Course Objectives and Outcome:A1-A2: Upon successful completion of the course, students can use Italian in everyday situations at level A1-A2 CEFR.B1: Upon successful completion of the course, students can use Italian in everyday situations at B1 CEFR level. Starting at this level, students are able to develop their language skills independently through application and further self-study.B2: Upon successful completion of the course, students will be able to independently use Italian at the B2 CEFR level in most daily and professional situations. They are able to express themselves on a wide range of topics, understand specialist discussions in their own specialist field, and communicate spontaneously and fluently so that a normal conversation with native speakers is possible without great effort. Starting from this level, the students can further develop their language skills with further self-study. C1: Upon successful completion of the course, students will be able to express themselves fluently and spontaneously without often having to search for words. They can use the language effectively and flexibly in social and professional life or in training and studies. Students can express themselves in a clear, structured, and detailed way on complex subjects, using various means of text linking appropriately. Starting from this level, the students can further develop their language skills in application and with further self-study.Course Content:The students are able to:Themes: Family (description and introduction of themselves, description and introduction of friends, colleagues and acquaintances); Living (living situation, places of residence); Leisure (shopping, hobbies, traveling, forms of travel, and recreation); Telephoning, reservations, confirmation of orders, feedback; Communication: "Small talk", meetings; Description of their living situation (living, work, and leisure)Grammar: includes past and present tense, sentence construction, and prepositions, etc.Contents of the course A2:The students are able to:Themes everyday life, work, education, studies; work situation, fields of work, places of work, professional goals; personality, description of characteristics; making appointments and agreements; communication: "small talk", talks about places of work, fields of work; description of work situationGrammar: includes imperfect and perfect tenses, the subjunctive, modal verbs, and syntaxContents of the course B1:The students are able to:Thematic: environment: description of places and countries (location, people, places of interest, and special features, etc.); events in business, culture, and politics of immediate importance; use of the foreign language in everyday professional situations; writing: coherent description of places, situations, experiences, recommendations; communication: dialogues, short lecturesGrammar: Training and extension of the applicable sentence tree possibilities (including the subjunctive in various tenses, imperatives, modal verbs, and relative clauses, etc.)Contents of the course B2:The students are able to:Themes: the work day, distribution, sales, communication, human resources, career, solutions for private and business tasksGrammar: includes verb constructions, conditional sentences, and indirect speech, etc.Contents of the course C1:The students are able to:Themes: describe complex issues in detail, link topics with each other, paying special attention to certain aspects, and giving an appropriate conclusionGrammar: includes verb constructions, conditional

Course Outcomes
On successful completion, students will be able to
Contents

Literature
Compulsory Reading
Further Reading ▪ according to the online course Rosetta Stone

Study Format Distance Learning

Study Format	Course Type
Distance Learning	

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Exam, 180 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
180 h	0 h	60 h	60 h	0 h	300 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☐ Shortcast	☐ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	

DLFLI01

Foreign Language French

Module Code: DLFLF

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

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

Module Coordinator

N.N (Foreign Language French)

Contributing Courses to Module

- Foreign Language French (DLFLF01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 180 Minutes	

Weight of Module

see curriculum

Module Contents

- Depending on the CEFR classification, students are qualified to
  - understand and use familiar everyday expressions and very simple sentences aimed at satisfying concrete needs. They can introduce themselves and others and ask other people questions about themselves – e.g., where they live, who they know, or what things they have – and answer questions of this kind. They can communicate in a simple way if the other party speaks slowly and clearly and is willing to help. (Level A1)**
  - understand sentences and frequently used expressions related to areas of most immediate relevance (e.g., personal and family information, shopping, work, and their local area). They can communicate in simple, routine situations that involve a simple and direct exchange of information about familiar and common things. They can use simple language to describe their own background and education, their immediate environment, and things related to their immediate needs. (level A2)**
  - understand the main points when clear standard language is used and when it comes to familiar matters about work, school, and leisure, etc. They can cope with most situations encountered when traveling in an area where the language is spoken. They can express themselves simply and coherently on familiar topics and personal areas of interest. They can report on experiences and events, describe dreams, hopes and goals, and give brief reasons or explanations for their plans and views. (level B1) **
  - understand the main contents of complex texts on concrete and abstract topics and, in their own field, also technical discussions. They can communicate spontaneously and fluently so that a normal conversation with native speakers is possible without much effort. They can express themselves clearly and in detail on a wide range of topics, explain a point of view on a topical issue, and indicate the advantages and disadvantages of different options. (level B2) **
  - understand a wide range of demanding, longer texts and also grasp implicit meanings. They can express themselves spontaneously and fluently without often having to search for words. They can use the language effectively and flexibly in social and professional life or in training and studies. They can express themselves in a clear, structured, and detailed manner on complex issues, using various means of text linking appropriately. (level C1)***
- Grammar:
  - Level A1 – includes present and past tenses, sentence construction, and prepositions, etc.
  - Level A2 – includes historical tenses, differences in times of the past, imperative, subordinate clauses, and pronouns (dative, accusative)
  - Level B1 – Among others, an introduction of the pluperfect, conjunctions, the passive, adverbs, adjectives (difference), and the future tense
  - Level B2 – Includes verb constructions, conditional sentences, and indirect speech, etc.
  - Level C1 – Exercises to consolidate and repeat what has been learned
- **Source
  http://www.coe.int/t/dg4/linguistic/Cadre1_en.asp
  and
  http://www.coe.int/t/dg4/linguistic/Source/Framework_EN.pdf
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Learning Outcomes **Foreign Language French** On successful completion, students will be able to	
Links to other Modules within the Study Program This module is similar to other modules in the field of Languages	**Links to other Study Programs of IUBH** All Distance Learning Bachelor Programmes

Foreign Language French

Course Code: DLFLF01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		10	none

Course Description

The qualification goals correspond to levels A1 through C1, according to the criteria of the Common European Framework of Reference for Languages (CEFR).A1/A2: The basics of French as a foreign language are taught and practiced using everyday topics and simple grammatical structures.B1: Independent use of French as a foreign language is taught, expanding the learner's grammatical knowledge and skills and developing their vocabulary in areas such as everyday working life, culture, business, and current events.B2: Independent use of French as a foreign language is taught and practiced by broadening and deepening previous grammatical knowledge and skills and expanding vocabulary in areas such as everyday work, culture, business, professional specializations, and current events.C1: Independent use of French as a foreign language is taught and practiced with a focus on extending and deepening previous grammatical knowledge and skills and expanding vocabulary in areas such as everyday working life, culture, economics, professional specializations, and current events.Course Objectives and Outcome:A1/A2: Upon successful completion of the course, students can use French in everyday situations at level A1/A2 CEFR.B1: Upon successful completion of the course, students can use French in everyday situations at level B1 CEFR. Starting at this level, students are able to develop their language skills independently through application and further self-study.B2: Upon successful completion of the course, students will be able to independently use French at the level B2 CEFR in most professional situations. They are able to express themselves on a wide range of topics, understand specialist discussions in their own specialist field, and communicate spontaneously and fluently so that a normal conversation with native speakers is possible without great effort. Starting from this level, students can further develop their language skills in application and with further self-study. C1: Upon successful completion of the course, students will be able to express themselves fluently and spontaneously without often having to search for words. They can use the language effectively and flexibly in social and professional life or in training and studies. Students can express themselves in a clear, structured, and detailed way on complex subjects, using various means of text linking appropriately. Starting from this level, the students can further develop their language skills in application and with further self-study.Course Content:The students are able to:Themes: Family (description and introduction of themselves, description and introduction of friends, colleagues, and acquaintances); Living (living situation and places of residence); Leisure (shopping, hobbies, traveling, forms of travel, and recreation); Telephoning, reservations, confirmation of orders, and feedback; Communication: "Small talk", meetings; Description of life situation (living, work, and leisure)Grammar: Includes present and past tense, sentence construction, and prepositions, etc.Contents of the course A2:The students are able to:Themes: everyday life, work, education, studies; work situation, fields of work, places of work, professional goals; personality, description of characteristics; making appointments and agreements; communication: "small talk", talks about places of work, fields of work; description of their work.Grammar: among other things, the imperfect and subjunctive tenses, modal verbs, and sentence constructionContents of the course B1:The students are able to:Themes: environment: description of places and countries (location, people, places of interest, and special features, etc.); events in business, culture, and politics of immediate importance; use of the foreign language in everyday professional situations; writing: coherent description of places, situations, experiences, recommendations; communication: dialogues and short lecturesGrammar: Training and extension of the applicable sentence tree possibilities (including the subjunctive in various tenses, the imperative, modal verbs, and relative clauses, etc.)Contents of the course B2:The students are able to:Themes: working day, distribution, sales, communication, human resources, career, solutions for private and business tasksGrammar: includes verb constructions, conditional sentences, and indirect speech, etc.Contents of the course C1:The students are able to:Themes: describe complex issues in detail, link topics with each other, paying special attention to certain aspects and giving an appropriate conclusion.Grammar: includes verb constructions, conditional sentences, and

Course Outcomes
On successful completion, students will be able to
Contents

Literature
Compulsory Reading
Further Reading ▪ according to the online course Rosetta Stone

Study Format Distance Learning

Study Format	Course Type
Distance Learning	

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Exam, 180 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
180 h	0 h	60 h	60 h	0 h	300 h

Instructional Methods

- ☐ Learning Sprints®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☐ Live Tutorium/Course Feed

DLFLF01

Foreign Language Spanish

Module Code: DLFLS

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

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

Module Coordinator

N.N. (Foreign Language Spanish)

Contributing Courses to Module

- Foreign Language Spanish (DLFLS01)

Module Exam Type

Module Exam	Split Exam
Study Format: Distance Learning Exam, 180 Minutes	

Weight of Module

see curriculum

Module Contents

- Depending on the CEFR classification, students will be able to
  - understand and use familiar everyday expressions and very simple sentences aimed at satisfying concrete needs. They can introduce themselves and others and ask other people questions about themselves - e.g., where they live, who they know, or what things they have - and provide answers to these kinds of questions. They can communicate in a simple way if the other party speaks slowly and clearly and is willing to help (Level A1).**
  - understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. personal and family information, shopping, work, and their local area). They can communicate in simple, routine situations that involve a simple and direct exchange of information about familiar and common things. They can use simple language to describe their own background and education, their immediate environment, and things related to their immediate needs (Level A2)**
  - understand the main points when clear standard language is used and when it comes to familiar matters about work, school, leisure, etc. They can cope with most situations encountered when travelling in an area where the language is spoken. They can express themselves simply and coherently on familiar topics and personal areas of interest. They can report on experiences and events, describe dreams, hopes and goals, and give brief reasons or explanations for their plans and views. (Level B1) **
  - understand the main content of complex texts on concrete and abstract topics and, in their own field, also technical discussions. They can communicate spontaneously and fluently so that a normal conversation with native speakers is possible without much mutual effort. They can express themselves clearly and in detail on a wide range of topics, explain a point of view on a topical issue, and indicate the advantages and disadvantages of different options. (Level B2) **
  - understand a wide range of demanding, longer texts and also grasp implicit meanings. They can express themselves spontaneously and fluently without having to search for words. They can use the language effectively and flexibly in social and professional life or in training and studies. They can express themselves in a clear, structured, and detailed manner on complex issues, using various means of text linking appropriately. (level C1)***
- Grammar:
  - Level A1 - Includes present and past tenses, sentence construction, and prepositions, etc.
  - Level A2 - Includes historical tenses, differences in times of the past, imperative, subordinate clauses, and pronouns (dative, accusative)
  - Level B1 - Among others, introduces the pluperfect, conjunctions, the passive, adverbs, adjectives (difference), and the future tense
  - Level B2 - Includes verb constructions, conditional sentences, and indirect speech, etc.
  - Level C1 – Includes exercises to consolidate and repeat what has been learned
- **Source
  http://www.coe.int/t/dg4/linguistic/Cadre1_en.asp
  and
  http://www.coe.int/t/dg4/linguistic/Source/Framework_EN.pdf
- ***Source
  http://www.goethe.de/z/50/commeuro/303.htm=- sync:ßÇÈâÈâ

Learning Outcomes **Foreign Language Spanish** On successful completion, students will be able to	
Links to other Modules within the Study Program This module is similar to other modules in the field of Languages	**Links to other Study Programs of IUBH** All Distance Learning Bachelor Programmes

Foreign Language Spanish

Course Code: DLFLS01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		10	none

Course Description

Study goals correspond to the language levels A1-C1, as specified in the Common European Framework of Reference for Languages (CEFR).A1-A2: The basic use of Spanish as a foreign language is taught and practiced on the basis of everyday topics and basic grammatical structures.B1: With an expansion of grammatical knowledge and skills and the development of vocabulary in fields such as everyday working life, culture, business and current events, the independent use of Spanish is taught and practiced.B2: The independent use of Spanish is taught and practiced with an extension and deepening of the previous grammatical knowledge and skills and the expansion of the vocabulary in fields such as everyday working life, culture, economics, professional specializations, and current events.C1: The independent use of Spanish is taught and practiced with an extension and deepening of the previous grammatical knowledge and skills and the expansion of the vocabulary in fields such as everyday working life, culture, economics, professional specializations, and current events.Course Objectives and Outcome:Course Objectives and Outcome:A1-A2: Upon successful completion of the course, students can use Spanish in everyday situations at level A1-A2 CEFR.B1: Upon successful completion of the course, students can use Spanish in everyday situations at B1 CEFR level. Starting at this level, students are able to develop their language skills independently through application and further self-study.B2: Upon successful completion of the course, students will be able to independently use Spanish at the B2 CEFR level in most daily and professional situations. They are able to express themselves on a wide range of topics in order to understand specialist discussions in their own specialist field, and to communicate spontaneously and fluently so that a normal conversation with native speakers is possible without great effort being made by either side. Starting from this level, students can further develop their language with further self-study.C1: Upon successful completion of the course, students will be able to express themselves fluently and spontaneously without having to search for words often. They can use the language effectively and flexibly in social and professional life or in training and studies. Students can express themselves in a clear, structured and detailed way on complex subjects, using various means of text linking appropriately. Starting from this level, the students can further develop their language skills with further self-study.Course Content:The students are able to:Themes: Family (description and introduction of themselves, description and introduction of friends, colleagues, and acquaintances); Living (living situation, places of residence); Leisure (shopping, hobbies, travelling, forms of travel, and recreation); Telephoning, reservation, confirmation of order, feedback; Communication: "Small talk", meetings; Description of daily life (living, work, and leisure)Grammar: includes present and past tense, sentence construction, and prepositions, etc.Contents of the course A2:The students are able to:Themes: everyday life, work, education, and studies; work situation, fields of work, places of work, professional goals; personality and description of characteristics; making appointments and agreements; communication: "small talk", talking about places of work, fields of work, describing their work situation.Grammar: includes the perfect and imperfect tenses, the subjunctive, modal verbs, and sentence structureContents of the course B1:The students are able to:Themes: environment: description of places and countries (location, people, places of interest, and special features, etc.); events in business, culture, and politics of immediate importance; use of the foreign language in everyday professional situations; writing: coherent description of places, situations, experiences, recommendations; communication: dialogues and short lectures.Grammar: Training and extension of the applicable sentence tree possibilities (including subjunctive in various tenses, imperative, modal verbs, and relative clauses, etc.)Contents of the course B2:The students are able to:Themes: working day, distribution, sales, communication, human resources, career, solutions for private and business tasksGrammar: includes verb constructions, conditional sentences, and indirect speech, etc.Contents of the course C1:The students are able to: Thematically: describe complex issues in detail, link topics with each other, paying special attention to certain aspects and giving an appropriate conclusionGrammar: including verb

Course Outcomes
On successful completion, students will be able to
Contents

Literature
Compulsory Reading
Further Reading ▪ according to the online course Rosetta Stone

Study Format Distance Learning

Study Format	Course Type
Distance Learning	

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
Type of Exam	Exam, 180 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
180 h	0 h	60 h	60 h	0 h	300 h

Instructional Methods

- ☐ Learning Sprints®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☐ Live Tutorium/Course Feed

DLFLS01

Introduction to Data Protection and Cyber Security

Module Code: DLBCSIDPITS

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

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

Module Coordinator

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

Contributing Courses to Module

- Introduction to Data Protection and Cyber Security (DLBCSIDPITS01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes

Introduction to Data Protection and Cyber Security

On successful completion, students will be able to

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

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

Introduction to Data Protection and Cyber Security

Course Code: DLBCSIDPITS01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Fundamentals of Data Protection and Cyber Security
   - 1.1 Conceptual Bases, Protection Goals
   - 1.2 Attacks and Threats
   - 1.3 Security Strategy
   - 1.4 Legal Regulations

2. Data Protection
   - 2.1 Data Protection as a Personal Right
   - 2.2 Basic Principles of Data Protection
   - 2.3 EU General Data Protection Regulation
   - 2.4 Further International Regulations on Data Protection
   - 2.5 Cross-Border Data Flow
   - 2.6 Data Protection in Everyday Life

3. Basic Functions of Cyber Security and Their Implementation
   - 3.1 Identification and Authentication
   - 3.2 Rights Management
   - 3.3 Rights Check
   - 3.4 Preservation of Evidence

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Eckert, C. (2014): IT-Sicherheit. Konzepte – Verfahren – Protokolle. 9. Auflage, De Gruyter, München.
- Poguntke, W. (2013): Basiswissen IT-Sicherheit. Das Wichtigste für den Schutz von Systemen & Daten. 3. Auflage, W3l, Dortmund.
- Witt, B. C. (2010): Datenschutz kompakt und verständlich. 2. Auflage, Vieweg+Teubner, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Online Lecture

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Exam, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
90 h	0 h	30 h	30 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☑ Exam Template	

DLBCSIDPITS01

Model Engineering

Module Code: DLBDSME

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

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

Module Coordinator

N.N. (Model Engineering)

Contributing Courses to Module

- Model Engineering (DLBDSME01)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

- Data science methodologies
- Model building
- Model evaluation
- Model combination
- Interpretable models

Learning Outcomes

Model Engineering

On successful completion, students will be able to

- understand common data science methodologies.
- create benchmark models.
- analyze models with respect to their interpretability.
- apply model validation techniques.
- recall established model combination techniques.

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

Model Engineering

Course Code: DLBDSME01

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

Course Description

Building high-quality predictive models is one of the core competencies of data scientists. This course begins with an introduction to relevant data science approaches such as CRISP-DM and Microsoft Team Data Science. The following section on model building focuses on the best practices that allow data scientists to build enterprise-grade models. Subsequent chapters explore techniques for model validation and model combination, also known as ensemble learning.Traditionally, the most explainable models have not been very powerful, and the most powerful models have not been very explainable. Nevertheless, interpretable models—and interpretable machine learning models in particular—are highly desirable in many areas. This course gives a detailed overview of common approaches, such as surrogate model visualizations, which illustrate the behavior of the models.

Course Outcomes

On successful completion, students will be able to

- understand common data science methodologies.
- create benchmark models.
- analyze models with respect to their interpretability.
- apply model validation techniques.
- recall established model combination techniques.

Contents

1. Data Science Methodologies
   - 1.1 CRISP-DM
   - 1.2 MS Team Data Science
2. Model Building
   - 2.1 Establishing a benchmark model
   - 2.2 Workflow automation
   - 2.3 Model persistence and model versioning
3. Model Evaluation
   - 3.1 Under- and overfitting
   - 3.2 Cross validation

4. Interpretable models
   - 4.1 Why interpretable models?
   - 4.2 Black-box versus interpretable models
   - 4.3 Visualizers for convolutional neural networks
   - 4.4 Surrogate models

5. Combining Learning Models
   - 5.1 Bagging
   - 5.2 Boosting
   - 5.3 Model stacking

Literature

Compulsory Reading

Further Reading

- Chapman, P. (n.d.). CRISP-DM user guide [PDF document]. Retrieved from https://s2.smu.edu/~mhd/8331f03/crisp.pdf
- Geron, A. (2017). Hands-on machine learning with Scikit-Learn and TensorFlow. Sebastopol, CA: O'Reilly.
- Kuhn, M., & Johnson, K. (2013). Applied predictive modeling. New York, NY: Springer.
- Maydanchik, A. (2007). Data quality assessment. Denville, NJ: Technics Publications.
- Microsoft. (2017). Team Data Science process documentation [training module]. Retrieved from https://docs.microsoft.com/en-us/azure/machine-learning/team-data-science-process/overview
- Molnar, C. (2019). Interpretable machine learning: A guide for making black box models explainable. Retrieved from https://christophm.github.io/interpretable-ml-book/
- Müller, A., & Guido, S. (2016). Introduction to machine learning with Python: A guide for data scientists. Sebastopol, CA: O'Reilly.
- Zheng, A. (2015). Evaluating machine learning models. Sebastopol, CA: O'Reilly.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Case Study

Information about the examination	
Examination Admission Requirements	**BOLK:** yes **Course Evaluation:** no
Type of Exam	Written Assessment: Case Study

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
110 h	0 h	20 h	20 h	0 h	150 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☑ Course Book	☐ Creative Lab
☐ Vodcast	☑ Guideline
☑ Shortcast	☐ Live Tutorium/Course Feed
☑ Audio	
☐ Exam Template	

Bachelor Thesis

Module Code: DLBBT

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

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

Module Coordinator

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

Contributing Courses to Module

- Bachelor Thesis (DLBBT01)
- Colloquium (DLBBT02)

Module Exam Type

Module Exam	Split Exam
	Bachelor Thesis • Study Format "Distance Learning": Written Assessment: Bachelor Thesis Colloquium • Study Format "Distance Learning": Presentation: Colloquium

Weight of Module

see curriculum

Module Contents

Bachelor Thesis

- Bachelor's thesis
- Colloquium on the bachelor's thesis

Colloquium

Learning Outcomes

Bachelor Thesis

On successful completion, students will be able to

- work on a problem from their major field of study by applying the specialist and methodological skills they have acquired during their studies.
- independently analyze selected tasks with scientific methods, critically evaluate them, and develop appropriate solutions under the guidance of an academic supervisor.
- record and analyze existing (research) literature appropriate to the topic of their bachelor's thesis.
- prepare a detailed written elaboration in compliance with scientific methods.

Colloquium

On successful completion, students will be able to

- present a problem from their field of study using academic presentation and communication techniques.
- reflect on the scientific and methodological approach chosen in their bachelor's thesis.
- demonstrate that they can actively answer subject-related questions from the subject experts (reviewers of the bachelor's thesis).

Links to other Modules within the Study Program	Links to other Study Programs of IUBH
All modules in the bachelor program	All bachelor programs in distance learning

Bachelor Thesis

Course Code: DLBBT01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		9	none

Course Description

The aim and purpose of the bachelor's thesis is to successfully apply the subject-specific and methodological competencies acquired during the course of study in the form of an academic dissertation with a thematic reference to the major field of study. The content of the bachelor's thesis can be a practical-empirical or theoretical-scientific problem. Students should prove that they can independently analyze a selected problem with scientific methods, critically evaluate it, and work out proposed solutions under the subject-methodological guidance of an academic supervisor. The topic chosen by the student from their respective field of study should meet the acquired scientific competences, deepening their academic knowledge and skills in order to meet the future needs of the field.

Course Outcomes

On successful completion, students will be able to

- work on a problem from their major field of study by applying the specialist and methodological skills they have acquired during their studies.
- independently analyze selected tasks with scientific methods, critically evaluate them, and develop appropriate solutions under the guidance of an academic supervisor.
- record and analyze existing (research) literature appropriate to the topic of their bachelor's thesis.
- prepare a detailed written elaboration in compliance with scientific methods.

Contents

- The bachelor's thesis must be written on a topic that relates to the content of the respective major field of study. In the context of the bachelor's thesis, the problem, as well as the scientific research goal, must be clearly emphasized. The work must reflect the current state of knowledge of the topic to be examined by means of an appropriate literature analysis. The student must prove their ability to use the acquired knowledge theoretically and/or empirically in the form of an independent and problem-solution-oriented application.

Literature
Compulsory Reading
Further Reading ▪ Hunziker, A.W. (2010): Spaß am wissenschaftlichen Arbeiten. So schreiben Sie eine gute Semester-, Bachelor- oder Masterarbeit. 4. Auflage, Verlag SKV, Zürich. ▪ Wehrlin, U. (2010): Wissenschaftliches Arbeiten und Schreiben. Leitfaden zur Erstellung von Bachelorarbeit, Masterarbeit und Dissertation – von der Recherche bis zur Buchveröffentlichung. AVM, München. ▪ Selection of literature according to topic

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** yes
Type of Exam	Written Assessment: Bachelor Thesis

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
270 h	0 h	0 h	0 h	0 h	270 h

Instructional Methods

- ☐ Learning Sprints®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☑ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☐ Live Tutorium/Course Feed

Colloquium

Course Code: DLBBT02

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		1	none

Course Description

The colloquium will take place after the submission of the bachelor's thesis. This is done at the invitation of the experts. During the colloquium, students must prove that they have independently produced the content and results of the written work. The content of the colloquium is a presentation of the most important work contents and research results by the student as well as the answering of questions by experts.

Course Outcomes

On successful completion, students will be able to

- present a problem from their field of study using academic presentation and communication techniques.
- reflect on the scientific and methodological approach chosen in their bachelor's thesis.
- demonstrate that they can actively answer subject-related questions from the subject experts (reviewers of the bachelor's thesis).

Contents

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

Literature

Compulsory Reading

Further Reading

- Renz, K.-C. (2016): Das 1 x 1 der Präsentation. Für Schule, Studium und Beruf. 2. Auflage, Springer Gabler, Wiesbaden.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis Defense

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** yes
Type of Exam	Presentation: Colloquium

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
30 h	0 h	0 h	0 h	0 h	30 h

Instructional Methods	
☐ Learning Sprints®	☐ Review Book
☐ Course Book	☐ Creative Lab
☐ Vodcast	☐ Guideline
☐ Shortcast	☐ Live Tutorium/Course Feed
☐ Audio	
☐ Exam Template	