MODULE HANDBOOK

Bachelor of Science

Applied Artificial Intelligence (FS-OI-BAAI)

180 ECTS

Distance Learning

INTERNATIONAL
UNIVERSITY OF
APPLIED SCIENCES

Classification: Undergraduate

Contents

2021-12-01

1. Semester

Artificial Intelligence

Module Code: DLBDSEAIS1

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

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

Module Coordinator
Prof. Dr. Ulrich Kerzel (Artificial Intelligence)

Contributing Courses to Module
▪ Artificial Intelligence (DLBDSEAIS01)

Module Exam Type	
Module Exam Study Format: Distance Learning Exam, 90 Minutes	**Split Exam**
Weight of Module see curriculum	

Module Contents

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

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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.

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Links to other Modules within the Study Program

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

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Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programs in the IT & Technology fields

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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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

Introduction to Academic Work

Module Code: DLBCSIAW

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

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

Module Coordinator

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

Contributing Courses to Module

- Introduction to Academic Work (DLBCSIAW01)

Module Exam Type	
Module Exam Study Format: myStudies Workbook Study Format: Distance Learning Workbook	**Split Exam**
Weight of Module see curriculum	

Module Contents

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

Learning Outcomes	
Introduction to Academic Work On successful completion, students will be able to ▪ understand and apply formal criteria of a scientific work. ▪ distinguish basic research methods and identify criteria of good scientific practice. ▪ describe central scientific theoretical basics and research paradigms and their effects on scientific research results. ▪ use literature databases, literature administration programs, and other library structures properly; avoid plagiarism; and apply citation styles correctly. ▪ apply the evidence criteria to scientific texts. ▪ define a research topic and derive a structure for scientific texts. ▪ compile a list of literature, illustrations, tables, and abbreviations for scientific texts. ▪ understand and distinguish between the different forms of scientific work at IU.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
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 IU examination forms and insight into their requirements and implementation.

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

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

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

5. Scientific Work at the IU – Research Essay

6. Scientific Work at the IU - Project Report

7. Scientific Work at the IU - Case Study

8. Scientific Work at the IU - Bachelor Thesis

9. Scientific Work at the IU – Oral Assignment

10. Scientific Work at the IU – Oral Project Report

11. Scientific Work at the IU - Colloquium

12. Scientific Work at the IU - Portfolio

13. Scientific Work at the IU - Exam

Literature
Compulsory Reading
Further Reading ▪ Bell, J. (2014). Doing your research project. [electronic resource] : a guide for first-time researchers. Berkshire: Open University Press ▪ Creswell, J. W., & Guetterman, T. C. (2020). Educational research [electronic resource] : planning, conducting, and evaluating quantitative and qualitative research. Harlow, Essex, United Kingdom Pearson Education Limited ▪ Neuman, W. L. (n.d.). Social Research Methods [electronic resource]: Pearson New International Edition: Qualitative and Quantitative Approaches. Pearson ▪ Paul Oliver. (2012). Succeeding with Your Literature Review: A Handbook for Students. Open University Press ▪ Schwaiger, M. [Ed., Taylor, C. R. [Ed., & Sarstedt, M. [Ed. (2011). Measurement and research methods in international marketing. Emerald ▪ Sonyel Oflazoglu. (2017). Qualitative versus Quantitative Research. ▪ Taylor, S. J., Bogdan, R., & DeVault, M. L. (2016). Introduction to qualitative research methods [electronic resource]: a guidebook and resource. Hoboken, New Jersey Wiley ▪ Thornhill, A., Saunders, M., & Lewis, P. (2019). Research methods for business students [electronic resource]. Harlow, England Pearson

Study Format myStudies

Study Format	Course Type
myStudies	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	

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes	
Introduction to Programming with Python On successful completion, students will be able to ▪ use fundamental Python syntax. ▪ recollect common elementary data types. ▪ recognize foundational programming concepts and their realization in Python. ▪ understand error handling and logging. ▪ create working programs. ▪ list the most important libraries and packages for data science.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
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. Sebastopol, CA: O'Reilly Media, Inc.
- Kapil, S. (2019). Clean Python: Elegant coding in Python. Berkeley, CA: Apress.
- Lubanovic, B. (2019). Introducing Python (2nd ed.). Sebastopol, CA: O’Reilly.
- Lutz, M. (2013). Learning Python (5th ed.). Sebastopol, CA: O’Reilly.
- Matthes, E. (2015). Python crash course: A hands-on, project-based introduction to programming. San Fransisco, CA: No Starch Press.
- Müller, A. C., & Guido, S. (2016). Introduction to machine learning with Python: A guide for data scientists. Sebastopol, CA: O'Reilly Media, Inc.
- Ramalho, L. (2015). Fluent Python: Clear, concise, and effective programming. Sebastopol, CA: O’Reilly.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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. Robert Graf (Mathematics: Analysis)

Contributing Courses to Module
▪ Mathematics: Analysis (DLBDSMFC01)

Module Exam Type	
Module Exam Study Format: Distance Learning Exam, 90 Minutes	**Split Exam**
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 IU International University of Applied Sciences**
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

- Deisenroth, M.P., Faisal, A.A., & Ong, C.S. (2020). Mathematics for Machine Learning. Cambridge University Press.
- Magnus, R. (2020). Fundamental Mathematical Analysis. Springer International 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®
☑ Course Book
☐ Vodcast
☑ Shortcast
☑ Audio
☑ Exam Template
☑ Review Book
☐ Creative Lab
☐ Guideline
☑ Live Tutorium/Course Feed

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 Study Format: myStudies Oral Assignment Study Format: Distance Learning Oral Assignment	**Split Exam**
Weight of Module see curriculum	

Module Contents

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

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

Contents

1. Learning for a Networked World in a Networked World
   - 1.1 Requirements and Opportunities 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

Literature
Compulsory Reading
Further Reading ▪ Baber, A., Waymon, L., Alphonso, A., & Wylde, J. (2015): Strategic connections. The new face of networking in a collaborative world. New York: AMACOM. ▪ Boulton, J. G., Allen, P. M., & Bowman, C. (2015): Embracing complexity. Strategic perspectives for an age of turbulence. 1. ed. Oxford: Oxford Univ. Press. ▪ Chang, B., & Kang, H. (2016): Challenges facing group work online. In: Distance Education 37 (1), S. 73–88. DOI: 10.1080/01587919.2016.1154781. ▪ Duhigg, C. (2013): The power of habit. Why we do what we do and how to change. London: Random House Books. ▪ Fisher, R., & Ury, W. (2012): Getting to yes. Negotiating an agreement without giving in. Updated and rev., 3. ed. London: Random House Business Books. ▪ Kaats, E., & Opheij, W. (2014): Creating conditions for promising collaboration. Alliances, networks, chains, strategic partnerships. Berlin, Heidelberg, s.l.: Springer Berlin Heidelberg (SpringerBriefs in Business). ▪ Martin, S. J., Goldstein, N. J., & Cialdini, R. B. (2015). The small BIG: Small changes that spark BIG influence. London, England: Profile Books. ▪ Oettingen, G. (2014). Rethinking positive thinking: Inside the new science of motivation. New York, NY: Current.

Study Format myStudies

Study Format	Course Type
myStudies	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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☐ Live Tutorium/Course Feed

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

Prof. 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 Study Format: myStudies Exam, 90 Minutes	

Weight of Module

see curriculum

Module Contents

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

<table>
<tr><td colspan="2">

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.

</td></tr>
<tr><td>Links to other Modules within the Study Program
This module is similar to other modules in the field of Methods</td><td>Links to other Study Programs of IU International University of Applied Sciences
All Bachelor Programmes in the Business & Management fields</td></tr>
</table>

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

- Downey, A.B. (2011). Think stats (2nd ed.). Sebastopol, CA: O'Reilly
- Kim, A. (2019). Exponential Distribution—Intuition, Derivation, and Applications. Available online.
- Wasserman, L. (2004). All of Statistics: A concise course in statistical inference. New York, NY: 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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☑ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☐ Live Tutorium/Course Feed

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☑ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed

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 Study Format: Distance Learning Portfolio	**Split Exam**
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 IU International University of Applied Sciences**
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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☑ Live Tutorium/Course Feed

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 IU International University of Applied Sciences**
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

- Mathai, A. M., & Haubold, H. J. (2017). Linear algebra, a course for physicists and engineers (1st ed.) De Gruyter.
- Neri, F. (2019). Linear algebra for computational sciences and engineering (2nd ed.) Springer.
- Shilov, G. E. (1977). Linear algebra. Dover Publications.
- Strang, G. (2020). Introduction to linear algebra. (5th ed.) Cambridge Press.

Study Format Distance Learning

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

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

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

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

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 Study Format: myStudies Written Assessment: Case Study Study Format: Distance Learning Written Assessment: Case Study	**Split Exam**
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 IU International University of Applied Sciences**
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

- Boylan, M. (Eds.). (2014). Business ethics. (2nd ed.). Wiley-Blackwell.
- Thomas, A., Kinast, E. U., Schroll-Machl, S. (Eds.). (2010). Handbook of intercultural communication and cooperation. Basics and areas of application. Vandenhoeck & Ruprecht .

Study Format myStudies

Study Format	Course Type
myStudies	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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☑ Live Tutorium/Course Feed

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☑ Live Tutorium/Course Feed

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 Study Format: Distance Learning Exam, 90 Minutes	**Split Exam**
Weight of Module see curriculum	

Module Contents

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

<table>
<tr><td colspan="2">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.</td></tr>
<tr><td>Links to other Modules within the Study Program

This module is similar to other modules in the field of Methods</td><td>Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programmes in the IT & Technology fields</td></tr>
</table>

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

- Wasserman, L. (2004). All of statistics: A concise course in statistical inference. Springer.
- Downey, A. B. (2014). Think stats (2nd ed.). O'Reilly.
- Downey, A.B. (2013). Think bayes. 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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☑ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☐ Live Tutorium/Course Feed

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 <u>Study Format: Distance Learning</u> Exam, 90 Minutes	**Split Exam**
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

<table>
<tr><td colspan="2">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</td></tr>
<tr><td>Links to other Modules within the Study Program

This module is similar to other modules in the fields of Data Science & Artificial Intelligence</td><td>Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programmes in the IT & Technology fields</td></tr>
</table>

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

Cloud Programming

Module Code: DLBSEPCP_E

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

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

Module Coordinator

Prof. Dr. Marian Benner-Wickner (Cloud Programming)

Contributing Courses to Module

- Cloud Programming (DLBSEPCP01_E)

Module Exam Type	
Module Exam Study Format: Distance Learning Portfolio	**Split Exam**
Weight of Module see curriculum	

Module Contents

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

Learning Outcomes	
Cloud Programming On successful completion, students will be able to ▪ associate characteristics of a cloud infrastructure as discussed in business with concrete implications for the machines deployed in the cloud. ▪ create a plan for a chosen cloud infrastructure provider and measure the achievement of this plan. ▪ specify by means of scripts, programs, documented web-platform usage, how the elements of a cloud service are created and measured. ▪ describe the risks, the protection measures, and the reaction measures of a cloud-service. ▪ demonstrate a running cloud-service created by the student and allow it to be tested in all its possible usage dimensions.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
This module is similar to other modules in the fields of Computer Science & Software Development	All Bachelor Programs in the IT & Technology fields

Cloud Programming

Course Code: DLBSEPCP01_E

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

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

Literature

Compulsory Reading

Further Reading

- Johnston, C., Advanced Platform Development with Kubernetes. Springer,
  https://doi-org.pxz.iubh.de:8443/10.1007/978-1-4842-5611-4
- Jonas, E., Schleier-Smith, J., Sreekanti , V., Tsai, C.-c., Khandelwal ,A., Pu, Q., Shankar, V., Carreira, J., Krauth, K., Jayant Yadwadkar, N., Gonzalez, J., Popa, R.A., Stoica, I., Patterson, D.: Cloud Programming Simplified: A Berkeley View on Serverless Computing. CoRR abs/1902.03383 (2019)
  https://arxiv.org/abs/1902.03383
- Talia, D., A view of programming scalable data analysis: from clouds to exascale, Journal of Cloud Computing: Advances, Systems and Applications (2019-02-01).
  https://doi.org/10.1186/s13677-019-0127-x
- Ponelat, J.S., Rosenstock, L.L., Designing APIs with Swagger and OpenAPI, Manning Publications, ISBN 9781617296284,
  https://www.manning.com/books/designing-apis-with-swagger-and-openapi

Study Format Distance Learning

Study Format Distance Learning	**Course Type** 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®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☑ Live Tutorium/Course Feed

3. Semester

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 IU International University of Applied Sciences**
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. (2006). Pattern recognition and machine learning. Springer.
- Grus, J. (2019). Data science from scratch: First principles with Python (2nd ed.). O'Reilly.
- Mitchell, T. M. (1997). Machine learning. McGraw-Hill.

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

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 Study Format: Distance Learning Written Assessment: Case Study	**Split Exam**
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. ▪ reflect on societal and sustainability implications of applying the learned skills to different use cases including ethical questions.

Links to other Modules within the Study Program	Links to other Study Programs of IU International University of Applied Sciences
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. By doing so, concepts and techniques are demonstrated by tangible examples which reflect usage of these techniques to generate added value for the society as a whole as opposed to ethical questionable use cases.

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.
- reflect on societal and sustainability implications of applying the learned skills to different use cases including ethical questions.

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

- Bonaccorso, G. (2019). Hands-on unsupervised learning with Python: Implement machine learning and deep learning models using Scikit-Learn, TensorFlow, and more. Packt Publishing Ltd.
- Celebi, M. E., & Aydin, K. (Eds.). (2016). Unsupervised learning algorithms. Springer International Publishing.
- Kane, F. (2017). Hands-on data science and Python machine learning. Packt Publishing Ltd.
- Patel, A. A. (2019). Hands-on unsupervised learning using Python: How to build applied machine learning solutions from unlabeled data. O'Reilly Media.

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

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. ▪ reason about the influence of model design and data selection on model outcomes in terms of social and personal equity.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
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. Moreover, by means of the accompanying video material and online tutorial support the impact of design choices and the data collection process on questions of algorithmic fairness both in terms of its individual as well as its societal dimension will be discussed.

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.
- reason about the influence of model design and data selection on model outcomes in terms of social and personal equity.

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

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.
- Gebru, T., and Woolery, E. (n.d.): Machine learning, bias, and product design. [Interview]. Design Better. Retrieved from https://www.designbetter.co/conversations/timnit-gebru.
- 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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☐ Live Tutorium/Course Feed

Introduction to Computer Vision

Module Code: DLBAIICV

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. (Introduction to Computer Vision)

Contributing Courses to Module

- Introduction to Computer Vision (DLBAIICV01)

Module Exam Type	
Module Exam Study Format: Distance Learning Exam, 90 Minutes	**Split Exam**
Weight of Module see curriculum	

Module Contents

- Vision Fundamentals
- Image Filtering
- Low-Level Vision
- High-Level Vision
- Video

Learning Outcomes	
Introduction to Computer Vision On successful completion, students will be able to ▪ remember important facts about image acquisition both in humans as well as technical systems. ▪ describe the importance of filtering in image processing and its practical application. ▪ know about the role and function of lower-level features such as edges or salient points in vision processing. ▪ explain how Deep Learning methods are successfully applied in high-level vision tasks. ▪ understand the particularities of video processing and know how to solve common problems related to the interpretation of video material.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
This module is similar to other modules in the fields of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology fields

Introduction to Computer Vision

Course Code: DLBAIICV01

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

Course Description

This course aims at laying the foundation in the understanding of Computer Vision. To this end, it starts with an introduction of the image acquisition process both from a biological as well as a technical perspective. Building upon that, the importance of filtering in image processing is explained and the necessary conceptual background is laid out. This enables the subsequent presentation of how crucial low-level features are generated from the raw image material. From there, the exposition moves on to describing current approaches to relevant high-level vision problems such as object recognition or image classification. Finally, the processing of video information is treated together with an exposition on modern approaches to solving salient Computer Vision tasks in this setting.

Course Outcomes

On successful completion, students will be able to

- remember important facts about image acquisition both in humans as well as technical systems.
- describe the importance of filtering in image processing and its practical application.
- know about the role and function of lower-level features such as edges or salient points in vision processing.
- explain how Deep Learning methods are successfully applied in high-level vision tasks.
- understand the particularities of video processing and know how to solve common problems related to the interpretation of video material.

Contents

1. Vision Fundamentals
   - 1.1 The Human Visual System
   - 1.2 Pinhole and Lens Cameras
   - 1.3 Image Sensors

2. Image Filtering
   - 2.1 Linear Shift Invariant Systems, Convolutions and the Point Spread Function
   - 2.2 Fourier Transform and Spatial Frequency
   - 2.3 Common Image Filters (Gaussian Smoothing, Median, Mode Filters, Rank Order)

3. Low-Level Vision
   - 3.1 Blobs
   - 3.2 Edges and Lines
   - 3.3 Corners and Points of Interest

4. High Level Vision
   - 4.1 Image Classification
   - 4.2 Semantic Segmentation
   - 4.3 Object Recognition

5. Video
   - 5.1 Fundamentals of Video Data, Motion and Optical Flow
   - 5.2 Object Tracking
   - 5.3 Action Classification

Literature

Compulsory Reading

Further Reading

- Davies, E.R. (2012). Computer and Machine Vision. 4th edition. Academic Press. London, Oxford, Boston, New York, and San Diego.
- Shanmugamani, R. (2018): Deep Learning for Computer Vision. Packt Publishing. Birmingham, UK.
- Szeliski, R. (2010) Computer Vision - Algorithms and Applications, Springer, Heidelberg.
- Fisher, R. B., Breckon, T. P., Dawson-Howe, K., Fitzgibbon, A., Robertson, C., Trucco, E., & Williams, C. K. I. (2016). Dictionary of computer vision and image processing. Chichester: John Wiley & Sons.

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

Project: Computer Vision

Module Code: DLBAIPCV

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. (Project: Computer Vision)

Contributing Courses to Module

- Project: Computer Vision (DLBAIPCV01)

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

Module Contents

In this project course the students work out a practical implementation of a Computer Vision use case.

Learning Outcomes	
Project: Computer Vision On successful completion, students will be able to ▪ apply the concepts covered in the preceding AI and Computer Vision courses to build a running Computer Vision system. ▪ explain the design choices made in the selection of the employed model or method and its implementation. ▪ transfer acquired theoretical knowledge to real case studies. ▪ translate the learned theories into the practice of Computer Vision system building. ▪ critically evaluate the resulting model's or system's performance.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
This module is similar to other modules in the fields of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology fields

Project: Computer Vision

Course Code: DLBAIPCV01

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

Course Description

In the course “Project Computer Vision” students choose a project task from a selection of options outlined in the pertaining project report guideline. The goal is to prototypically implement a Computer Vision system in a suitable development environment using apposite tools and code libraries. The choice of approach, the implemented system or software and the resulting performance on the task are to be reasoned about, explained, and documented in a project report. To this end, students make practical use of the methodological knowledge acquired in the previous courses by applying them to relevant real-world problems.

Course Outcomes

On successful completion, students will be able to

- apply the concepts covered in the preceding AI and Computer Vision courses to build a running Computer Vision system.
- explain the design choices made in the selection of the employed model or method and its implementation.
- transfer acquired theoretical knowledge to real case studies.
- translate the learned theories into the practice of Computer Vision system building.
- critically evaluate the resulting model’s or system’s performance.

Contents

- In this project course the students work out a practical implementation of a Computer Vision use case choosing from a selection given in the complementary project report guideline. All relevant artifacts like use case evaluation, chosen implementation method, code, and outcomes are to be documented in the form of a written project report.

Literature
Compulsory Reading
Further Reading ▪ Demmagd, K., Oliver, A., Oostendopr, N., Scott, K. (2012): Practical Computer Vision with SimpleCV. O'Reilly Media Inc., Beijing, Cambridge, Farnham, Köln, Sabastopol, Tokyo. ▪ Solem, J.E. (2012): Programming Computer Vision with Python. O'Reilly Media Inc., Beijing, Cambridge, Farnham, Köln, Sabastopol, Tokyo. ▪ Martinez, J. (2021): TensorFlow 2.0 Computer Vision Cookbook. Packt Publishing, Birmingham. ▪ Ranjan, S., and Senthamilarasu, S. (2020): Applied Deep Learning and Computer Vision for Self-Driving Cars. Packt Publishing, Birmingham.

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

Introduction to Reinforcement Learning

Module Code: DLBAIIRL

Module Type	Admission Requirements	Study Level	CP	Student Workload
see curriculum	DLBDSNNDL01	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. (Introduction to Reinforcement Learning)

Contributing Courses to Module

- Introduction to Reinforcement Learning (DLBAIIRL01)

Module Exam Type	
Module Exam Study Format: Distance Learning Exam, 90 Minutes	**Split Exam**
Weight of Module see curriculum	

Module Contents

- Introduction to Reinforcement Learning
- Sequential Decision Process
- Dynamic Programming
- Temporal-Difference Learning
- Deep Reinforcement Learning

Learning Outcomes	
Introduction to Reinforcement Learning On successful completion, students will be able to ▪ remember the concepts of reinforcement learning. ▪ understand sequential and Markov decision processes. ▪ apply Q-Learning methods to reinforcement learning problems. ▪ apply neural networks to deep reinforcement learning approaches.	
Links to other Modules within the Study Program This module is similar to other modules in the fields of Data Science & Artificial Intelligence	**Links to other Study Programs of IU International University of Applied Sciences** All Bachelor Programs in the IT & Technology fields

Introduction to Reinforcement Learning

Course Code: DLBAIIRL01

Study Level	Language of Instruction	Contact Hours	CP	Admission Requirements
BA	English		5	DLBDSNNDL01

Course Description

Reinforcement learning allows computers to derive problem-solving strategies without being explicitly programmed for the specific task, similar to the way humans and animals learn.After a general introduction to the field of reinforcement learning, the course discusses sequential decision processes and dynamic programming in detail. These concepts are the foundation upon which most of the theory of reinforcement learning is built and is crucial to the further understanding of the topic.The course explains temporal-difference learning as a classical reinforcement leaning technique and highlights two of the most important algorithms: Q-learning and SARSA, as well as understanding the tradeoff between exploration and exploitation. Afterwards, the course turns to modern reinforcement learning approaches with deep neural networks, including a detailed discussion of how to optimize the training of deep reinforcement learning techniques as well as discussing notable applications and examples.

Course Outcomes

On successful completion, students will be able to

- remember the concepts of reinforcement learning.
- understand sequential and Markov decision processes.
- apply Q-Learning methods to reinforcement learning problems.
- apply neural networks to deep reinforcement learning approaches.

Contents

1. Introduction to Reinforcement Learning
   - 1.1 Objectives of Reinforcement Learning
   - 1.2 Components of Reinforcement Learning Systems
   - 1.3 Reinforcement Learning versus Supervised and Unsupervised Machine Learning

2. Sequential Decision Process
   - 2.1 Introduction to Sequential Decision Processes
   - 2.2 Observations, Cost and Rewards
   - 2.3 Markov Decision Processes

3. Dynamic Programming
   - 3.1 Policies and Actions
   - 3.2 Value Functions
   - 3.3 Policy and Value Iteration
   - 3.4 Bellman’s Equation

4. Reinforcement Learning Algorithms and their Properties
   - 4.1 Temporal-Difference Learning and Q-Factors
   - 4.2 Exploration versus Exploitation
   - 4.3 On-Policy Learning: SARSA
   - 4.4 Off-Policy Learning: Q-Learning

5. Deep Reinforcement Learning
   - 5.1 Neural Networks in Q-Learning
   - 5.2 Optimizing Deep Reinforcement Learning
   - 5.3 Applications and Examples

Literature

Compulsory Reading

Further Reading

- Geron, A. (2019). Hands-on machine learning with Scikit-Learn and TensorFlow. 2nd Edition. Boston, MA: O’Reilly Publishing.
- Kolobov, A., & Mausam. (2012). Planning with Markov decision processes: An AI perspective. San Rafael, CA: Morgan & Claypool.
- Powell, W. (2011). Approximate Dynamic Programming (2nd ed.). Hoboken, NJ: John Wiley & Sons.
- Sutton, R., & Barto, A. (2018). Reinforcement learning: An introduction (2nd ed.). Boston, MA: MIT Press.
- Szepesvári, C. (2010). Algorithms for reinforcement learning. San Rafael, CA: Morgan & Claypool.
- Wiering, M., & Otterlo, M. (2012). Reinforcement learning: State of the art. Berlin: 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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

4. Semester

Introduction to NLP

Module Code: DLBAIINLP

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

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

Module Coordinator

Prof. Dr. Ulrich Kerzel (Introduction to NLP)

Contributing Courses to Module

- Introduction to NLP (DLBAIINLP01)

Module Exam Type	
Module Exam Study Format: Distance Learning Exam, 90 Minutes	**Split Exam**
Weight of Module see curriculum	

Module Contents

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

<table>
<tr><td colspan="2">Learning Outcomes

Introduction to NLP

On successful completion, students will be able to
▪ get a good overview of the topic NLP.
▪ name important challenges in NLP.
▪ apply common algorithms and methods to address NLP problems.
▪ understand common use-case scenarios in which NLP techniques are applied.
▪ analyze benefits and shortcomings of various NLP algorithms.</td></tr>
<tr><td>Links to other Modules within the Study Program

This module is similar to other modules in the field of Data Science & Artificial Intelligence</td><td>Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programs in the field of IT & Technology</td></tr>
</table>

Introduction to NLP

Course Code: DLBAIINLP01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Basic Terms and Concepts
   - 1.1 What is NLP?
   - 1.2 Syntax
   - 1.3 Semantics
   - 1.4 Prosodics
   - 1.5 Grammar

2. Language and Speech
   - 2.1 Human Vocal Apparatus
   - 2.2 Speech Producation
   - 2.3 Phonetics

3. Challenges in NLP
   - 3.1 Data for NLP
   - 3.2 Evaluation of NLP Systems
   - 3.3 Domain Challenges
   - 3.4 Multilingual Application

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

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

Literature

Compulsory Reading

Further Reading

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

Study Format Distance Learning

Study Format	Course Type
Distance Learning	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

Project: NLP

Module Code: DLBAIPNLP

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

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

Module Coordinator

Prof. Dr. Ulrich Kerzel (Project: NLP)

Contributing Courses to Module

- Project: NLP (DLBAIPNLP01)

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

Module Contents

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

Learning Outcomes	
Project: NLP On successful completion, students will be able to ▪ apply knowledge of NLP methods to practical problems. ▪ evaluate and apply different methods, algorithms, and approaches to solve a given problem, taking into account its constraints. ▪ recognize the benefits and shortcomings of options and decisions. ▪ implement real-world NLP applications.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
This module is similar to other modules in the field of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology field

Project: NLP

Course Code: DLBAIPNLP01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

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

Literature

Compulsory Reading

Further Reading

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

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☐ Live Tutorium/Course Feed

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

Weight of Module

see curriculum

Module Contents

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

Learning Outcomes	
Introduction to Data Protection and Cyber Security On successful completion, students will be able to ▪ explain the terms and concepts of IT security and know the typical procedures and techniques which exist in each area. ▪ cite the legal regulations on data protection and explain their implementation. ▪ discuss in-depth IT security management and suitable measures for implementation. ▪ use their overview knowledge of activities and strategies for IT security in software and system development.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
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

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

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed

Study Format Distance Learning

Study Format Distance Learning	**Course Type** 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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed

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

<table>
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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.

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<tr><td>

Links to other Modules within the Study Program

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

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Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programmes in the IT & Technology fields

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</table>

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

- Brookshear, G., & Brylow, D. (2019). Computer science: An overview. Pearson Education.
- Hunt, A., & Thomas, D. (1999). The pragmatic programmer: From journeyman to master. Addison-Wesley.
- Martin, R. C. (2008). Clean code. Prentice Hall.
- Sammons, A. (2019). Agile project management with Scrum + Kanban 2 In 1: The last 2 approaches you'll need to become more productive and meet your project goals. M & M Limitless.
- Stephens, R. (2015). Beginning software engineering. John Wiley & Sons

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

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 Study Format: Distance Learning Oral Project Report	**Split Exam**
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 IU International University of Applied Sciences**
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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☑ Live Tutorium/Course Feed

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
Prof. Dr. Claudia Hess (Seminar: Ethical Considerations in Data Science)

Contributing Courses to Module
▪ Seminar: Ethical Considerations in Data Science (DLBDSSECDS01)

Module Exam Type	
Module Exam Study Format: Distance Learning Written Assessment: Research Essay	**Split Exam**
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 IU International University of Applied Sciences**
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

- Association for Computing Machinery (ACM) (2018).ACM Code of Ethics and Professional Conduct. Retrieved from https://www.acm.org/code-of-ethics.
- Baer, T. (2019). Understand, Manage, and Prevent Algorithmic Bias. A Guide for Business Users and Data Scientists. Apress.
- Bloom, P. (2019). Monitored. Business and surveillance in a time of big data. Pluto Press; Knowledge Unlatched.
- Garzcarek, U. & Steuer, D. (2019). Approaching Ethical Guidelines for Data Scientists. In Bauer,N., Ickstadt, K., Lübke, K.,Szepannek,G., Trautmann, H.&Vichi, M.(Eds.): Applications in statistical computing. From music data analysis to industrial quality improvement(pp.151–169). Springer.
- O'Neil, C. (2017). Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books.
- O'Neil, C. (2017). Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books.
- Yarali, A., Joyce, R.& Dixon, B. (2020, April 22-24). Ethics of Big Data: Privacy, Security and Trust.2020 Wireless Telecommunications Symposium (WTS), Washington DC, United States.

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	

5. Semester

User Experience

Module Code: DLBMIUEX1_E

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

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

Module Coordinator

Prof. Dr. Katharina Bredies (User Experience)

Contributing Courses to Module

- User Experience (DLBMIUEX01_E)

Module Exam Type

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

Weight of Module

see curriculum

Module Contents

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

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Learning Outcomes

User Experience

On successful completion, students will be able to

- describe, classify, and delimit the term user experience and its concepts.
- analyze touchpoints, create customer journey maps and describe personas.
- describe suitable techniques for user experience design and select them for a specific task.
- describe techniques for evaluating UX and identify appropriate ones for specific tasks.
- describe and delimit selected techniques for information design.
- describe and delimit concepts and approaches for designing user experience at the process, service and enterprise levels.
- engage in interdisciplinary team work and communicate comprehensively with UX professionals with complementary backgrounds and skill sets.

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Links to other Modules within the Study Program

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

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Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programs in the Design, Architecture & Construction fields

</td></tr>
</table>

User Experience

Course Code: DLBMIUEX01_E

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

Course Description

The term user experience (UX) generally refers to the experience that users and customers have in relationship to the products and services that a company offers. It is not only about improving the usability of IT systems, but also about analyzing, designing and evaluating the experience of users and customers. After an introduction to the topic of user experience, some methods for analyzing the user experience will be explained and their application will be discussed. Then, selected techniques for designing user experience and suitable approaches to information design are introduced. After that specific techniques for evaluating UX are discussed. Finally, it will be explained how UX can be designed specifically at the level of services and companies.

Course Outcomes

On successful completion, students will be able to

- describe, classify, and delimit the term user experience and its concepts.
- analyze touchpoints, create customer journey maps and describe personas.
- describe suitable techniques for user experience design and select them for a specific task.
- describe techniques for evaluating UX and identify appropriate ones for specific tasks.
- describe and delimit selected techniques for information design.
- describe and delimit concepts and approaches for designing user experience at the process, service and enterprise levels.
- engage in interdisciplinary team work and communicate comprehensively with UX professionals with complementary backgrounds and skill sets.

Contents

1. UX Basics
   - 1.1 Terms, Concepts, History
   - 1.2 User Experience Design and Management
   - 1.3 Selected Scenarios from Practice

2. Analysis
   - 2.1 Contextual Inquiry
   - 2.2 Touchpoint Analysis
   - 2.3 Customer Journey Map
   - 2.4 Persona

3. Finding Ideas
   - 3.1 Use Cases
   - 3.2 User Stories
   - 3.3 Storyboards

4. Design and Prototyping
   - 4.1 The Human Perception
   - 4.2 Card Sorting
   - 4.3 Sketches and Scribbles
   - 4.4 Wireframes
   - 4.5 Prototyping
   - 4.6 Guidelines and Style Guides

5. Evaluation
   - 5.1 Usability Testing
   - 5.2 Observation Techniques
   - 5.3 Interview Techniques and Questionnaires

6. "UX on a Large Scale"
   - 6.1 UX in Services and Business Processes
   - 6.2 Corporate UX

Literature
Compulsory Reading
Further Reading ▪ Buxton, William. Sketching User Experience: Getting the Design Right and the Right Design. San Francisco, Calif.: Morgan Kaufmann, 2007. Book. ▪ Garrett, Jesse James. The Elements of User Experience : User-Centered Design for the Web and Beyond. Voices That Matter Ser. Vol. 2nd ed., New edition, revised, Berkeley: New Riders, 2010. Book. ▪ Kuniavsky, Mike, Andrea Moed, and Elizabeth Goodman. Observing the User Experience [Electronic Resource] : A Practitioner's Guide to User Research. Waltham, MA Morgan Kaufmann, 2nd ed, 2012. ▪ Norman, Don. The Design of Everyday Things : Revised and Expanded Edition. Vol. Revised and expanded edition, New York: Basic Books, 2013. Book. ▪ Saul, Greenberg, Carpendale Sheelagh, Marquardt Nicolai, and Buxton Bill. Sketching User Experiences: The Workbook. Waltham, Mass: Morgan Kaufmann, 2012. Book. ▪ Brown, Diana DeMarco. Agile User Experience Design a Practitioner's Guide to Making It Work. Amsterdam [u.a.]: Elsevier MK, 2013. Monograph. ▪ Robier, Johannes. "Ux Redefined. Winning and Keeping Customers with Enhanced Usability and User Experience." Belgium, Europe: Springer International Publishing, 2016.

Study Format Distance Learning

Study Format	**Course Type**
Distance Learning	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

UX-Project

Module Code: DLBMIUEX2_E

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

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

Module Coordinator
N.N. (UX-Project)

Contributing Courses to Module
▪ UX-Project (DLBMIUEX02_E)

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

Module Contents
Practical project with focus on UX.

Learning Outcomes	
UX-Project On successful completion, students will be able to ▪ independently carry out small and medium-sized project tasks in the field of UX and produce an appropriate result. ▪ define a suitable approach to UX projects and identify appropriate techniques and methods specifically. ▪ critically reflect and document the work process and the achieved result regarding the target achievement.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
This module is similar to other modules in the field of Design	All Bachelor Programs in the Design, Architecture & Construction fields

UX-Project

Course Code: DLBMIUEX02_E

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

Course Description

The aim of the module is to apply the already acquired knowledge and skills on the subject of User Experience in a practical project. The students work on a self-organized project with focus on User Experience.

Course Outcomes

On successful completion, students will be able to

- independently carry out small and medium-sized project tasks in the field of UX and produce an appropriate result.
- define a suitable approach to UX projects and identify appropriate techniques and methods specifically.
- critically reflect and document the work process and the achieved result regarding the target achievement.

Contents

- The knowledge acquired in the course User Experience is applied to projects. The approach, the results achieved and the critical reflection are documented in a written project report.

Literature

Compulsory Reading

Further Reading

- Barnum, Carol M. . Usability Testing Essentials : Ready, Set...Test! Amsterdam: Morgan Kaufmann, 2011. eBook.
- Cooper, Alan, Robert Reimann, David Cronin, and Christopher Noessel. About Face: The Essentials of Interaction Design. 4th ed. Hoboken: Wiley, 2014. eBook.
- Hartson, Rex, and Pardha S. Pyla. the Ux Book: Agile Ux Design for a Quality User Experience. 2nd ed. Cambridge: Morgan Kaufman, 2019. eBook.
- Robier, Johannes. "Ux Redefined. Winning and Keeping Customers with Enhanced Usability and User Experience." Belgium, Europe: Springer International Publishing, 2016. eBook.

Study Format 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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☐ Live Tutorium/Course Feed

Project: Edge AI

Module Code: DLBAIPEAI

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. (Project: Edge AI)

Contributing Courses to Module
▪ Project: Edge AI (DLBAIPEAI01)

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

Module Contents
This project focuses on designing and prototyping an Edge AI system.

<table>
<tr><td colspan="2">Learning Outcomes

Project: Edge AI

On successful completion, students will be able to
▪ combine a range of AI techniques in a technical implementation.
▪ explain the design choices and its implementation.
▪ transfer acquired theoretical knowledge to a real-world project.
▪ translate the learned theories into the practice of AI system building.
▪ critically evaluate the resulting model or system’s performance.</td></tr>
<tr><td>Links to other Modules within the Study Program

This module is similar to other modules in the fields of Data Science & Artificial Intelligence</td><td>Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programs in the IT & Technology fields</td></tr>
</table>

Project: Edge AI

Course Code: DLBAIPEAI01

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

Course Description

Edge AI is an important part of artificial intelligence and becomes more and more important in modern system implementations. Instead of large computers or server farms, AI inferences are calculated in the physical system where they are needed. Examples for such a setup are autonomous vehicles interpreting sensor data and images, mobile systems, but also cyber-physical systems where “intelligence” needs to be close to the physical production system.Students learn how to evaluate the requirements of a complete Edge AI system, determine its requirements, and evaluate the constraints of the intended use and available edge computing resources. In the course “Project: Edge AI”, students choose a project task in accord with their tutor from a variety of options. The goal is to prototypically implement an Edge AI solution. The design and implementation choices, requirement and constraints are to be reasoned about, explained, and documented in a project report. To this end, students make practical use of the methodological knowledge acquired in the previous courses by applying them to relevant real-world problems.

Course Outcomes

On successful completion, students will be able to

- combine a range of AI techniques in a technical implementation.
- explain the design choices and its implementation.
- transfer acquired theoretical knowledge to a real-world project.
- translate the learned theories into the practice of AI system building.
- critically evaluate the resulting model or system’s performance.

Contents

- In this course the students work on a practical prototype implementation of an edge AI system. All relevant artifacts such as the design documentation, chosen implementation, code and the complete system, as well as outcomes are to be documented. Depending on the exact system that is to be designed and implemented as a prototype, students will draw on the theoretical knowledge gained from some or all of the previous courses and combine them in a new way to design an edge AI system.

Literature
Compulsory Reading
Further Reading ▪ Geron, A. (2019). Hands-on machine learning with Scikit-Learn and TensorFlow. 2nd Edition. Boston, MA: O'Reilly Publishing. ▪ Koul, A, Ganju, S & Kasam, M (2019). Practical Deep Learning for Cloud, Mobile& Edge: Computer Vision Projects Using Python, Keras & TensorFlow. Boston, MA: O'Reilly Publishing. ▪ Russel, S., & Norvig, P. (2009). Artificial intelligence: A modern approach (3rd ed.). Malaysia: Pearson. ▪ Wang, X., Han, Y., Leung, V. C., Niyato, D., Yan, X., & Chen, X. (2020). Edge AI: Convergence of Edge Computing and Artificial Intelligence. Springer Nature. ▪ Warden, P. & Situnayake, D. (2020). TinyML . Boston, MA: 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	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®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☐ Live Tutorium/Course Feed

Introduction to Robotics

Module Code: DLBROIR_E

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

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

Module Coordinator
Prof. Dr. Matthias Eifler (Introduction to Robotics)

Contributing Courses to Module
▪ Introduction to Robotics (DLBROIR01_E)

Module Exam Type	
Module Exam Study Format: Distance Learning Exam or Written Assessment: Written Assignment, 90 Minutes Study Format: myStudies Exam or Written Assessment: Written Assignment, 90 Minutes	**Split Exam**
Weight of Module see curriculum	

Module Contents
▪ Introduction to Robotics ▪ Trends ▪ Industrial Robots ▪ Mobile Robots ▪ Applications

Learning Outcomes	
Introduction to Robotics On successful completion, students will be able to ▪ name important developments in the field of robotics. ▪ understand the mechanical structure and characteristics of robots. ▪ name characteristics and challenges of industrial robots. ▪ name characteristics and challenges of mobile robots. ▪ understand the role of robots in applications. ▪ name and understand current trends in the field of robotics.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
This module is similar to other modules in the field of Engineering	All Bachelor Programmes in the IT & Technology fields

Introduction to Robotics

Course Code: DLBROIR01_E

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

Course Description

Robotics is experiencing very interesting developments, which experts describe as being a transition to a new generation of robots. We have moved from the “4Ds” of Robotics 1.0 (dull, dirty, dumb, dangerous) to the “4Ss” of Robotics 2.0 (smarter, safer, sensors, simple), but we still need to proceed further to the “4Ms” of Robotics 3.0 (multitasking, emotive, morphing, multiagent). This course, thus, provides the required background to understand the main development of robotics looking at industrial as well as at mobile robots, their main characteristics, issues, challenges, applications, and development trends.

Course Outcomes

On successful completion, students will be able to

- name important developments in the field of robotics.
- understand the mechanical structure and characteristics of robots.
- name characteristics and challenges of industrial robots.
- name characteristics and challenges of mobile robots.
- understand the role of robots in applications.
- name and understand current trends in the field of robotics.

Contents

1. What is Robotics?
   - 1.1 Basics and Definitions
   - 1.2 History and Cultural Influence
   - 1.3 Challenges and Trends (from Robotics 1.0 to Robotics 3.0)

2. Robots
   - 2.1 Mechanical Structure
   - 2.2 Kinematic Chains
   - 2.3 Market Overview

3. Industrial Robots
   - 3.1 Components of Industrial Robot Systems
   - 3.2 Characteristics
   - 3.3 Common Industrial Robots
   - 3.4 Applications
   - 3.5 Trends

4. Mobile Robots
   - 4.1 Components of Mobile Robot Systems
   - 4.2 Characteristics
   - 4.3 Common Mobile Robots
   - 4.4 Applications
   - 4.5 Trends

5. Applications
   - 5.1 Industrial Robots
   - 5.2 Healthcare
   - 5.3 Agriculture or Field Robotics
   - 5.4 Space and Defense
   - 5.5 Warehouse and Logistics
   - 5.6 Construction
   - 5.7 Wearables
   - 5.8 Social Robots

Literature

Compulsory Reading

Further Reading

- Mihelj, M., Bajd, T., Ude, A., Lenarcic, J., Stanovnik, A., Munih, M., Rejc, J., & Slajpah, S. (2019). Robotics(2nd ed.). Springer.
- Ben-Ari, M., & Mondada, F. (2017). Elements of robotics. Springer.
- Siciliano, B., & Khatib, O. (Eds.). (2016). Springer handbook of robotics. Springer

Study Format 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 or Written Assessment: Written Assignment, 90 Minutes

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

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

Study Format myStudies

Study Format	Course Type
myStudies	Lecture

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

Student Workload					
Self Study	**Presence**	**Tutorial**	**Self Test**	**Practical Experience**	**Hours Total**
100 h	0 h	25 h	25 h	0 h	150 h

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

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
Prof. Dr. Inga Schlömer (Agile Project Management)

Contributing Courses to Module
▪ Agile Project Management (DLBCSAPM01)

Module Exam Type	
Module Exam	**Split Exam**
Study Format: myStudies Written Assessment: Project Report 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. ▪ consider the increasing relevance of international, intercultural and virtual collaboration in projects.	
Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
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.
- consider the increasing relevance of international, intercultural and virtual collaboration in projects.

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 ▪ Chovanova, H. et al. (2020). Agile Project Management – What is It?:IEEE. In 18th International Conference on Emerging eLearning Technologies and Applications (ICETA), Emerging eLearning Technologies and Applications (ICETA), 2020 18th International Conference. ▪ Douglass, B. P. (2016). Agile systems engineering. Morgan Kaufmann, p. 151-160 ▪ Project Management Institute (2017). Agile Practice Guide. Project Management Institute. ▪ Measey P./Radtac (2015). Agile Foundations -Principles, Practices and Frameworks. BCS The Chartered Institute for IT, p. 131-140, p. 148-152. ▪ Schwaber, K./Sutherland, J. (2020). The Scrum Guide. (URL: https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf#zoom=100 [last accessed on 23.06.2021]) ▪ Beck, K. et al. (2001). Manifesto for Agile Software Development. (URL: https://agilemanifesto.org/ [last accessed on 23.06.2021]). ▪ Dalton, Jeff (2019). Great Big Agile. An OS for Agile Leaders. ▪ Apress.Agile Alliance (2021). Subway Map to Agile Practices. (URL: https://www.agilealliance.org/agile101/subway-map-to-agile-practices/ [last accessed on 23.06.2021]).

Study Format myStudies

Study Format	Course Type
myStudies	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®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☐ Live Tutorium/Course Feed

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

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 IU International University of Applied Sciences
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 calibration
   - 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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☑ Live Tutorium/Course Feed

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 "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes (50) Automation and Robotics • Study Format "Distance Learning": Exam, 90 Minutes (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 IU International University of Applied Sciences**
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

Literature
Compulsory Reading
Further Reading ▪ Anderson, C. (2012): Makers. The new industrial revolution. Crown Business, New York. ▪ Gebhardt, A. (2012): Understanding Additive Manufacturing. Rapid Prototyping – Rapid Tooling – Rapid Manufacturing. Hanser, München/Cincinnati. ▪ Gibson, I., Rosen, D., Stucker, B., & Khorasani, M. (2021). Additive Manufacturing Technologies (3rd ed.). Springer International Publishing. ▪ Groover, M. P., (2019). Fundamentals of Modern Manufacturing: Materials, Processes, and Systems (7th ed.). Wiley. ▪ Kalpakjian, S., & Schmid, S.R. (2020). Manufacturing Engineering and Technology (8th ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

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

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

- Czichos, H. (2018). Measurement, testing and sensor technology: Fundamentals and application to materials and technical systems. Springer International Publishing.
- Jazar, R. N. (2010). Theory of Applied Robotics (2. Auflage): Springer US, Boston.
- Manesis, S., & Nikolakopoulos, G. (2020). Introduction to industrial automation. CRC Press, Taylor & Francis Group.
- Nise, N. S. (2019). Control systems engineering (8th ed.). Wiley.
- Siciliano, B., Sciavicco, L., Villani, L., & Oriolo, G. (2009). Robotics - Modeling, Planning and Control. Springer London.
- Singh, K. K., Nayyar, A., Tanwar, S., & Abouhawwash, M. (2021). Emergence of Cyber Physical System and IoT in Smart Automation and Robotics. Springer International 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	

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 IU International University of Applied Sciences
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®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☑ Live Tutorium/Course Feed

Digital Signal Processing and Sensor Technology

Module Code: DLBAIEDSPST

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. (Digital Signal Processing) / Prof. Dr. Matthias Eifler (Sensor Technology)

Contributing Courses to Module
▪ Digital Signal Processing (DLBROEICR01_E) ▪ Sensor Technology (DLBROST01_E)

Module Exam Type	
Module Exam	**Split Exam** Digital Signal Processing • Study Format "Distance Learning": Exam, 90 Minutes (50) Sensor Technology • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes
Weight of Module see curriculum	

Module Contents

Digital Signal Processing

- Signal sampling and quantization
- Digital signals and systems
- Discrete Fourier Transform
- z-Transform
- Digital signal processing and filters

Sensor Technology

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

Learning Outcomes

Digital Signal Processing

On successful completion, students will be able to

- analyze discrete time systems.
- apply analysis tools such as the Discrete Fourier Transform.
- apply the z-Transform.
- analyze properties of discrete systems.
- design finite and infinite impulse response filters.
- implement filters in hardware and software.

Sensor Technology

On successful completion, students will be able to

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

Links to other Modules within the Study Program	Links to other Study Programs of IU International University of Applied Sciences
This module is similar to other modules in the field of Engineering	All Bachelor Programs in the IT & Technology fields

Digital Signal Processing

Course Code: DLBROEICR01_E

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

Course Description

Digital signal processing enables digital audio and video extraction, as well as extraction of important features from any other kind of signal, for instance medial imagery or diagnostic tools. This course provides the students with expertise on the theory and practice of digital signal processing. In the first part, theoretical concepts are introduced, presenting the main tools for analysis of digital, i.e., sampled or discrete-time systems. The core of digital signal processing resides in the design of a digital filter. The second part of the course focuses on different filter-design approaches, i.e. a discussion on finite impulse response and infinite impulse response filters. The last part gives important insights into the hardware and software implementation of digital signal processing, bridging theory with applied practice.

Course Outcomes

On successful completion, students will be able to

- analyze discrete time systems.
- apply analysis tools such as the Discrete Fourier Transform.
- apply the z-Transform.
- analyze properties of discrete systems.
- design finite and infinite impulse response filters.
- implement filters in hardware and software.

Contents

1. Introduction
   - 1.1 Basic Concepts
   - 1.2 Applications

2. Signal Sampling and Quantization
   - 2.1 Sampling
   - 2.2 Signal reconstruction
   - 2.3 Analog-to-digital Conversion
   - 2.4 Digital-to-Analog Conversion
   - 2.5 Quantization

8. Infinite Impulse Response Filter Design
   - 8.1 Basics
   - 8.2 Bilinear Transformation Design Method
   - 8.3 Butterworth and Chebyschev Filter Designs
   - 8.4 Higher-Order Infinite Impulse Response Filter Design
   - 8.5 Pole-Zero Placement for Simple Filters
   - 8.6 Applications

9. Hardware and Software for Digital Signal Processing
   - 9.1 Digital Signal Processor Architecture
   - 9.2 Digital Signal Processor Hardware Units
   - 9.3 Fixed-Point and Floating-Point Formats
   - 9.4 Implementation of FIR and IIR Filters in Fixed-Point
   - 9.5 DSP Programming Examples

Literature

Compulsory Reading

Further Reading

- Manolakis, D. G./Ingle, V. K. (2011): Applied digital signal processing: theory and practice. Cambridge University Press, Cambridge.
- Tan, L./Jiang, J. (2013): Digital signal processing: fundamentals and applications. 2nd ed., Academic Press, Cambridge, MS.
- Vetterli, M./Kovačević, J./Goyal, V. K. (2014): Foundations of signal processing. 2nd ed., Cambridge University Press, Cambridge.

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☐ Live Tutorium/Course Feed

Sensor Technology

Course Code: DLBROST01_E

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Introduction to Measurement Uncertainty
   - 1.1 Measurement Uncertainty
   - 1.2 Confidence Intervals
   - 1.3 Expression of Uncertainty

2. Sensors
   - 2.1 Sensors and Transducers
   - 2.2 Selection of Sensors
   - 2.3 Sensor Characteristics
   - 2.4 Measurement Systems and Components

3. Resistive Sensors
   3.1 Resistivity and Resistance
   3.2 Potentiometric Sensors
   3.3 Strain Gauges
   3.4 Piezoresistive Sensors
   3.5 Magnetoresistive Sensors
   3.6 Thermoresistive Sensors
   3.7 Optoresistive Sensors

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

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Kalantar-Zadeh, K. (2013): Sensors: An Introductory Course. Springer US, New York, NY.
- Lin, Y. L. et al (eds.) (2015): Smart Sensors and Systems. Springer International Publishing, Cham.
- Mukhopadhyay, S. C. (ed.) (2016): Next Generation Sensors and Systems. In: Smart Sensors, Measurement and Instrumentation, Vol. 16. Springer International Publishing, Cham.
- Regtien, P./Dertien, E. (2018): Sensors for Mechatronics. 2nd ed., Elsevier, Amsterdam.

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

DLBROST01_E

Database Developer

Module Code: DLBAIEDD

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. Ralf Kneuper (Database Modeling and Database Systems) / Sharam Dadashnia (Project: Build a Data Mart in SQL)

Contributing Courses to Module

- Database Modeling and Database Systems (DLBCSDMDS01)
- Project: Build a Data Mart in SQL (DLBDSPBDM01)

Module Exam Type

Module Exam	Split Exam
	<u>Database Modeling and Database Systems</u> • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes <u>Project: Build a Data Mart in SQL</u> • Study Format "Distance Learning": Portfolio • Study Format "myStudies": Portfolio

Weight of Module

see curriculum

Module Contents

Database Modeling and Database Systems

- 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

Project: Build a Data Mart in SQL

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

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.

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 IU International University of Applied Sciences
This module is similar to other modules in the fields of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology fields

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

- 46th VLDB (2020). Proceedings of the International Conference on Very Large Data Bases (VLDB).
- Date, C.J. (2019). Database design and relational theory: Normal forms and all that jazz (2nd ed.). Apress.
- Documentation of Mondial Database (2010). Mondial Database.
- Elmasri, R., Navathe, S. B. (2016). Fundamentals of database systems. Pearson Education Limited.
- Foster, E., Godbole, S. (2016). Database systems. A pragmatic approach. (2nd ed.). Apress.
- Sumathi, S. et al (2010). Fundamentals of relational database management systems. Springer.
- W3Schools (2020). SQL Tutorial.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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: 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	

Study Format myStudies

Study Format	Course Type
myStudies	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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☑ Live Tutorium/Course Feed

Business Intelligence

Module Code: DLBCSEBI

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

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

Module Coordinator

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

Contributing Courses to Module

- Business Intelligence (DLBCSEBI01)
- Project: Business Intelligence (DLBCSEBI02)

Module Exam Type

Module Exam	Split Exam
	Business Intelligence • Study Format "Distance Learning": Exam, 90 Minutes Project: Business Intelligence • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

<table>
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Module Contents

Business Intelligence

- Basics of mobile software development
- Android system architecture
- Development environment
- Core components of an Android app
- Interaction between application components
- Advanced techniques

Project: Business Intelligence

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

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Learning Outcomes

Business Intelligence

On successful completion, students will be able to

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

Project: Business Intelligence

On successful completion, students will be able to

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

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Links to other Modules within the Study Program

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

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Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programmes in the IT & Technology fields

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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

- Grossmann, W., & Rinderle-Ma, S. (2015). Fundamentals of business intelligence. Springer.
- Kolb, J. (2013). Business intelligence in plain language: A practical guide to data mining and business analytics. Createspace.
- Sharda, R., Delen, D., & Turban, E. (2014). Business intelligence and analytics: Systems for decision support. Pearson.
- Sherman, R. (2014). Business intelligence guidebook: From data integration to analytics. Morgan Kaufmann.
- Vaisman, A., & Zimányi, E. (2016). Data warehouse systems: Design and implementation. 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	

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

- Christoph Meinel, Hasso Plattner, Larry Leifer (2011): Design Thinking: Understand – Improve – Apply; Springer Berlin Heidelberg
- Jeanne Liedtka (2018): Why Design Thinking Works. In: Havard Business Review, Issue: 2018/09, pp.72–79
- Christoph Meinel, Larry J. Leifer (2021): Design Thinking Research: Interrogating the Doing; Springer International 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	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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☐ Live Tutorium/Course Feed

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 IU International University of Applied Sciences
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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☑ Live Tutorium/Course Feed

Augmented, Mixed and Virtual Reality

Module Code: DLBMIAMVR_E

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

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

Module Coordinator
N.N. (Augmented, Mixed and Virtual Reality) / N.N. (X-Reality Project)

Contributing Courses to Module
▪ Augmented, Mixed and Virtual Reality (DLBMIAMVR01_E) ▪ X-Reality Project (DLBMIAMVR02_E)

Module Exam Type	
Module Exam	**Split Exam** Augmented, Mixed and Virtual Reality • Study Format "Distance Learning": Exam, 90 Minutes X-Reality Project • Study Format "Distance Learning": Written Assessment: Project Report
Weight of Module see curriculum	

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Module Contents

Augmented, Mixed and Virtual Reality

- Definition and Differentiation of Terms
- Fields of Application and Examples
- Aspects of Human Perception
- Augmented and Virtual Reality Output Devices
- Input Devices
- Interaction in Virtual and Augmented Realities
- Aspects of XR Application Development
- Future of XR Technologies

X-Reality Project

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

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Learning Outcomes

Augmented, Mixed and Virtual Reality

On successful completion, students will be able to

- name the characteristics and differences of augmented, mixed, and virtual reality techniques.
- describe the importance of sensual perception in AR and VR.
- explain the basic technical features of AR and VR systems.
- explain the different interaction possibilities in AR and VR applications.
- perform selected development processes for AR and VR applications.

X-Reality Project

On successful completion, students will be able to

- implement a small AR/VR application by themselves.
- experiment with the concept of AR/VR applications.
- discuss challenges and issues in AR/VR software development.
- document the concept and implementation of independently developed AR/VR applications and accumulated experience in a project report.

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Links to other Modules within the Study Program

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

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Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programs in the IT & Technology fields

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Augmented, Mixed and Virtual Reality

Course Code: DLBMIAMVR01_E

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

Course Description

Augmented, mixed and virtual reality (AR, MR and VR) technologies are becoming increasingly important in a wide range of application areas. In this context, novel hardware devices and forms of interaction are used. In addition to the technical foundations, this course covers aspects of human perception and approaches for developing AR/VR applications. To give the students a knowledge of the field, the terms augmented, mixed, and virtual reality will be defined and differentiated and examples of their use will be demonstrated. In order to simulate the existence of a virtual world or virtual objects to users, aspects of human perception have to be used. Based on the fundamentals of human information processing, the course highlights the phenomena, problems, and solutions that have to be considered in AR and VR applications. AR and VR systems can be implemented in different ways. This course addresses different output forms, tracking methods and interaction possibilities. In addition, other techniques that are specifically relevant in the AR field will be represented. Software development in the AR and VR field may require the application of special processes. This course teaches selected approaches that are helpful in designing, prototyping, and testing AR and VR applications. The course concludes with a view at the future applications and the research potential of augmented, mixed, and virtual reality.

Course Outcomes

On successful completion, students will be able to

- name the characteristics and differences of augmented, mixed, and virtual reality techniques.
- describe the importance of sensual perception in AR and VR.
- explain the basic technical features of AR and VR systems.
- explain the different interaction possibilities in AR and VR applications.
- perform selected development processes for AR and VR applications.

Contents

1. Introduction to Augmented, Mixed and Virtual Reality
   1.1 Definition and Differentiation of Terms
   1.2 Fields of Application and Examples

2. Aspects of Human Perception
   - 2.1 Human Information Processing
   - 2.2 Visual Perception
   - 2.3 Multisensory Perception
   - 2.4 Phenomena, Problems and Solutions

3. Virtual Reality Output Devices
   - 3.1 Mounts for Smartphones
   - 3.2 Simple 3-Degrees-of-Freedom VR Glasses
   - 3.3 6-Degrees-of-Freedom-VR
   - 3.4 Multisensor Technology

4. Augmented Reality Output Devices
   - 4.1 Tracking
   - 4.2 Video See-Through vs. Optical See-Through vs. Projection
   - 4.3 General Differences between Devices

5. Input Devices
   - 5.1 Controller and Other Devices
   - 5.2 Touchpads
   - 5.3 Voice Commands
   - 5.4 Finger Tracking
   - 5.5 Eye Tracking
   - 5.6 Neurofeedback

6. Interaction in Virtual and Augmented Realities
   - 6.1 Fundamentals of Human-Computer Interaction
   - 6.2 Selection
   - 6.3 Manipulation of Objects
   - 6.4 Navigation
   - 6.5 Perceptual Variables

7. Aspects of Development
   - 7.1 Iterative Development Approaches for VR/AR Applications
   - 7.2 Design Techniques
   - 7.3 Prototyping
   - 7.4 Evaluation

8. The Future of Augmented, Mixed and Virtual Reality
    8.1 Outlook on Future Applications
    8.2 Focus Points for Future Research

Literature

Compulsory Reading

Further Reading

- Billinghurst, M./Clark, A./Lee, G.: "A Survey of Augmented Reality". In: Foundations and Trends in Human-Computer Interaction, Vol. 8, Nr. 2-3, S.73-272.
- Jerald, J. (2016): The VR Book. Human-Centered Design for Virtual Reality. ACM und Morgan & Claypool.
- Schmalstieg, D./Höllerer, T. (2016): Augmented Reality. Principles and Practice. Addison-Wesley.

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

X-Reality Project

Course Code: DLBMIAMVR02_E

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

Course Description

The students create an application from the field of augmented or virtual reality by themselves and document its conception and implementation as well as collected experiences. The development of an AR/VR application may include special steps that are not known from classic software applications. In this context, AR- or VR-typical elements of the application should be explicitly highlighted and challenges and problems should be addressed.

Course Outcomes

On successful completion, students will be able to

- implement a small AR/VR application by themselves.
- experiment with the concept of AR/VR applications.
- discuss challenges and issues in AR/VR software development.
- document the concept and implementation of independently developed AR/VR applications and accumulated experience in a project report.

Contents

- The students work on a project from the field of augmented or virtual reality. They design and implement an AR/VR application based on a concrete task. The development of the application as well as collected experiences are documented in a project report. The project report first presents the project goal as well as the topic and context of the application. Then the requirements, the conception and the implementation of the application are described. During the documentation, AR- or VR-typical elements will be explicitly highlighted. The report concludes by highlighting the challenges and issues that arose during development.

Literature

Compulsory Reading

Further Reading

- Buttfield-Addison, P., Manning, J., Nugent, T. (2019): Unity Game Development Cookbook: Essentials for Every Game. O'Reilly.
- Linowes, J. (2015): Unity virtual reality projects. Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D. Packt Publishing.
- Linowes, J./Babilinski, K. (2017): Augmented Reality for Developers. Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☐ Live Tutorium/Course Feed

6. Semester

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** <u>International Marketing</u> • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes <u>International Brand Management</u> • Study Format "myStudies": Exam, 90 Minutes • 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 IU International University of Applied Sciences**
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

Literature
Compulsory Reading
Further Reading ▪ Armstrong, G., Kotler, P., & Opresnik, M. O. (2019). Marketing: An introduction (14th ed.). Pearson. ▪ Green, M. C., & Keegan, W. J. (2020). Global marketing (10th ed.). Pearson. ▪ Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). Cultures and organizations—Software of the mind: Intercultural cooperation and its importance for survival. McGraw-Hill. ▪ Hollensen, S. (2020). Global marketing (8th ed.). Pearson. ▪ Mooij, M. (2018). Global marketing and advertising: Understanding cultural paradoxes (5th ed.). Sage Publications.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

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

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

- Gelder, S. v. (2003): Global Brand Strategy. Unlocking Brand Potential Across Countries, Cultures and Markets. Kogan Page, London.
- Keller, K. L. (2007): Strategic Brand Management. Building, Measuring and Managing Brand Equity. 3. Auflage, Prentice Hall International, Edinburgh.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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 IU International University of Applied Sciences**
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

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

- Jobber, D./Lancaster, G./Le Meunier-Fitzhugh, K. (2019): Selling and Sales Management, 11th Ed.; Pearson
- Johnston, M.W./Marshall (2021): Sales Force Management: Leadership, Innovation, Technology; Routledge
- Jordan, J./Vazzana, M. (2011): Cracking the Sales Management Code: The Secrets to Measuring and Managing Sales Performance; 13th Ed.; McGraw Hill
- Kumar, V./Reinartz, W. (2018): Customer Relationship Management: Concept, Strategy, and Tools; 3rd Ed.; Springer Texts in Business and Economics
- Marcos, J./Davies, M. (2019): Implementing Key Account Management: Designing Customer-Centric Processes for Mutual Growth; KoganPage
- Peppers, D./Rogers, M. (2011): Managing Customer Relationships : A Strategic Framework; 2nd Ed.; 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

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

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

- Jobber, D./Lancaster, G./Le Meunier-Fitzhugh, K. (2019): Selling and Sales Management, 11th Ed.; Pearson
- Johnston, M.W./Marshall (2021): Sales Force Management: Leadership, Innovation, Technology; Routledge
- Jordan, J./Vazzana, M. (2011): Cracking the Sales Management Code: The Secrets to Measuring and Managing Sales Performance; 13th Ed.; McGraw Hill
- Kumar, V./Reinartz, W. (2018): Customer Relationship Management: Concept, Strategy, and Tools; 3rd Ed.; Springer Texts in Business and Economics
- Marcos, J./Davies, M. (2019): Implementing Key Account Management: Designing Customer-Centric Processes for Mutual Growth; KoganPage
- Peppers, D./Rogers, M. (2011): Managing Customer Relationships : A Strategic Framework; 2nd Ed.; 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

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

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
Prof. Dr. Hubert Vogl (Supply Chain Management I) / N.N. (Supply Chain Management II)

Contributing Courses to Module
▪ Supply Chain Management I (DLBDSESCM01) ▪ Supply Chain Management II (DLBDSESCM02)

Module Exam Type	
Module Exam	**Split Exam** Supply Chain Management I • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Supply Chain Management II • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes (-)
Weight of Module see curriculum	

Module Contents

Supply Chain Management I

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

Supply Chain Management II

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

Learning Outcomes

Supply Chain Management I

On successful completion, students will be able to

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

Supply Chain Management II

On successful completion, students will be able to

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

Links to other Modules within the Study Program	Links to other Study Programs of IU International University of Applied Sciences
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

2. Selected Theoretical Concepts for the Supply Chain Concept
    - 2.1 New Institutional Economics
    - 2.2 Game Theory
    - 2.3 Network Approach
    - 2.4 Other Theoretical Additions

3. Supply Chain Management
    - 3.1 Basic Information on the Goals and Scope of SCM
    - 3.2 Popular Problem Areas of the SCM
    - 3.3 Supply Chain Management as an Evolutionary Step in Logistics
    - 3.4 Supply Chain Management as Cooperation Management

4. SCM Model
    - 4.1 Basic Information on the Term SCM Models
    - 4.2 SCOR Model
    - 4.3 SCM Task Model

5. SCM as a Coordination Problem
    - 5.1 Basic Information on the Concept of Coordination
    - 5.2 Coordination Concepts, Context, and Perspectives of SCM
    - 5.3 Coordination Instruments

Literature
Compulsory Reading
Further Reading ▪ Bookbinder, J. H. (2013). Handbook of global logistics: Transportation in international supply chains. International series in operations research & management science: Bd. 181. Springer. ▪ Chopra, S (2019). Supply Chain Management: Strategy, Planning, and Operation, EBook, Global Edition, Pearson Education, Limited. ProQuest Ebook Central. ▪ Chopra, S. & Meindl, P. (2016). Supply chain management: Strategy, planning, and operation. Always learning. Pearson. ▪ Christopher, M. (2016). Logistics & supply chain management (Fifth edition). Pearson. ▪ Ganesan, R. (2015). The profitable supply chain: A practitioner's guide. Apress. ▪ Grant, D. B. (2012). Logistics management. Pearson. ▪ Kurbel, K. (2013). Enterprise resource planning and supply chain management: Functions, business processes and software for manufacturing companies. Progress in IS. Springer. ▪ Pawar, K. S., Rogers, H., Potter, A. & Naim, M. (2015). Developments in Logistics and Supply Chain Management: Past, Present and Future. Palgrave Macmillan. ▪ Piotrowicz, W. & Cuthbertson, R. (Hrsg.). (2015). Supply chain design and management for emerging markets: Learning from countries and regions. Springer International Publishing. ▪ Scott, C., Lundgren, H. & Thompson, P. (2018). Guide to Supply Chain Management: An end to end perspective. Management for professionals. Springer. ▪ Sindi, S. & Roe, M. (2017). Strategic supply chain management: The development of a diagnostic model. Palgrave Macmillan.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

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

Literature
Compulsory Reading
Further Reading ▪ Bookbinder, J. H. (2013). Handbook of global logistics: Transportation in international supply chains. International series in operations research & management science: Bd. 181. Springer. ▪ Chopra, S (2019). Supply Chain Management: Strategy, Planning, and Operation, EBook, Global Edition, Pearson Education, Limited. ProQuest Ebook Central. ▪ Chopra, S. & Meindl, P. (2016). Supply chain management: Strategy, planning, and operation. Always learning. Pearson. ▪ Christopher, M. (2016). Logistics & supply chain management (Fifth edition). Pearson. ▪ Ganesan, R. (2015). The profitable supply chain: A practitioner's guide. Apress. ▪ Grant, D. B. (2012). Logistics management. Pearson. ▪ Kurbel, K. (2013). Enterprise resource planning and supply chain management: Functions, business processes and software for manufacturing companies. Progress in IS. Springer. ▪ Pawar, K. S., Rogers, H., Potter, A. & Naim, M. (2015). Developments in Logistics and Supply Chain Management: Past, Present and Future. Palgrave Macmillan. ▪ Piotrowicz, W. & Cuthbertson, R. (Hrsg.). (2015). Supply chain design and management for emerging markets: Learning from countries and regions. Springer International Publishing. ▪ Scott, C., Lundgren, H. & Thompson, P. (2018). Guide to Supply Chain Management: An end to end perspective. Management for professionals. Springer. ▪ Sindi, S. & Roe, M. (2017). Strategic supply chain management: The development of a diagnostic model. Palgrave Macmillan.

Study Format myStudies

Study Format myStudies	Course Type Lecture

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

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

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

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	

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": Exam Financial Services Management II • Study Format "Distance Learning": Exam
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 IU International University of Applied Sciences
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

2. Financial Intermediation
   - 2.1 The Banking System
   - 2.2 Asset Management Companies and Insurance Companies
   - 2.3 Regulations and Supervision

3. Financial Services
   - 3.1 Financing Needs
   - 3.2 The Range of Financial Services

4. Debt Financing Through Financial Intermediaries
   - 4.1 Types of Loans
   - 4.2 Lending and Collateralization
   - 4.3 Credit Substitutes

5. Equity Financing Through Financial Intermediaries
   - 5.1 Equity Financing Through Capital Participation and Venture Financing Companies
   - 5.2 Equity Capital Markets Issuance
   - 5.3 Disintermediation in Finance

Literature

Compulsory Reading

Further Reading

- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10th edition, McGraw-Hill, London.
- Rose, P.; Hudgins, S. (2012): Bank Management & Financial Services. 9th edition. McGraw-Hill.
- Titman, S., Keown, A.J., Martin, J. D. (2016): Financial Management: Principles and Applications. 13th edition, Pearson, New York.

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	☐ Reader
☑ Exam Template	☐ Slides

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
    3.4 Other Tangible Assets

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

- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10th edition, McGraw-Hill, London.
- Rose, P.; Hudgins, S. (2012): Bank Management & Financial Services. 9th edition. McGraw-Hill.
- Titman, S., Keown, A.J., Martin, J. D. (2016): Financial Management: Principles and Applications. 13th edition, Pearson, New York.

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	☐ Reader
☑ Exam Template	☐ Slides

IT project and architecture management

Module Code: DLBCSEITPAM

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. (IT Project Management) / Prof. Dr. Tobias Brückmann (IT Architecture Management)

Contributing Courses to Module
▪ IT Project Management (DLBCSEITPAM01) ▪ IT Architecture Management (DLBCSEITPAM02)

Module Exam Type	
Module Exam	**Split Exam** IT Project Management • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes IT Architecture Management • Study Format "Distance Learning": Exam, 90 Minutes
Weight of Module see curriculum	

Module Contents

IT Project Management

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

IT Architecture Management

- Basic terms and foundations of IT enterprise architectures management
- IT application portfolio management
- Architecture governance
- Modeling of IT enterprise architectures
- Frameworks using TOGAF as an example
- Reference models and sample catalogues

Learning Outcomes

IT Project Management

On successful completion, students will be able to

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

IT Architecture Management

On successful completion, students will be able to

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

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

IT Project Management

Course Code: DLBCSEITPAM01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Basics Terms and Foundations of IT Project Management
   - 1.1 Definition of a Project and Types of IT Projects
   - 1.2 IT Project Lifecycle
   - 1.3 Multi-Project Management – The Project in the Context of the Organization

2. Planning Techniques
   - 2.1 Large-Scale Planning: Milestones, Sub-tasks, and Work Packages
   - 2.2 Large-Scale Planning: Gantt Charts
   - 2.3 Planning and Organization of Work Packages: Kanban Board

3. Prioritization, Estimation of Costs, Project Controlling
   - 3.1 Prioritization
   - 3.2 Estimation of Costs
   - 3.3 Project Controlling

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

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

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

Literature

Compulsory Reading

Further Reading

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Project Management Institute (2017). Newtown Square, PA, USA, 6th Ed., 589 pages.
- IPMA Individual Competence Baseline for Project, Programme & Portfolio Management International Project Management Association (2015). 4th Ed., 416 pages.
- IPMA Organisational Competence Baseline International Project Management Association (2016). 112 pages.
- Nexus™ Guide Schwaber, K. (2015). Scrum.org, Boston, MA, USA, 11 pages.
- Phillips, J. (2010): IT Project Management. On Track from Start to Finish. 3. Auflage, McGraw-Hill, New York, NY.
- Project Management: A Systems Approach to Planning, Scheduling, and Controlling Kerzner, H. (2017). Wiley & Sons, Hoboken, NJ, USA, 12th Ed., 848 pages.
- Project Management: A Managerial Approach Meredith, J.R., Mantel, S.J. (2015). Wiley & Sons, Hoboken, NJ, USA, 9th Ed., 512 pages.
- Schwalbe, K. (2010): Information Technology Project Management. 6. Auflage, Course Technology, Independence, KY.
- The Scrum Guide™ Schwaber, K., Sutherland (2013). Scrum.org, Boston, MA, USA, 16 pages.
- The Mythical Man Month Fred Brooks, JR (1975). Addison.Wesley

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

Study Format myStudies

Study Format	Course Type
myStudies	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	

IT Architecture Management

Course Code: DLBCSEITPAM02

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Basic Terms and Foundation for the Management of IT Enterprise Architectures
   - 1.1 IT Enterprise Architecture
   - 1.2 Goals of Enterprise Architecture Management
   - 1.3 Processes in the Management of IT Enterprise Architectures

2. IT Application Portfolio Management
   - 2.1 IT Application Portfolio Management Overview
   - 2.2 Application Manual
   - 2.3 Portfolio Analysis
   - 2.4 Development Planning

3. Architecture Governance
    - 3.1 Organizational Structure
    - 3.2 Policy Development and Enforcement
    - 3.3 Project Support

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

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

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

Literature

Compulsory Reading

Further Reading

- Bernard, S. A. (2020): An Introduction to holistic Enterprise Architecture: Fourth Edition, AuthorHouse, 4th Edition, 322 pages.
- G. R&A (2015): Chess and the Art of Enterprise Architecture Wierda, 252 pages
- Ross, J. W./ Weill, P./Robertson, D. C. (2006): Enterprise Architecture as Strategy. Creating a Foundation for Business Execution. Harvard Business Review Press, Boston, 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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

Psychology of Human Computer Interaction

Module Code: DLBKPSWPMCI_E

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

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

Module Coordinator
N.N. (Experience Psychology) / N.N. (Human Computer Interaction)

Contributing Courses to Module
▪ Experience Psychology (DLBUXEP01_E) ▪ Human Computer Interaction (DLBUXHCI01_E)

Module Exam Type	
Module Exam	**Split Exam** Experience Psychology • Study Format "Distance Learning": Exam, 90 Minutes Human Computer Interaction • Study Format "Distance Learning": Exam, 90 Minutes
Weight of Module see curriculum	

Module Contents
Experience Psychology ▪ Physiological and Psychological Basics of User Experience ▪ Future Human-Machine Relationships based on Artificial Intelligence ▪ Emotional Impact of Design ▪ User Experience regarding Design Aspects **Human Computer Interaction** ▪ Basics of Human Information Processing ▪ Physiological and Psychological Aspects of Human Perception, Cognition and Behavior ▪ Technical Framework of Human-Computer Interaction ▪ Trends in Human-Computer Interaction

Learning Outcomes
Experience Psychology On successful completion, students will be able to ▪ outline physiological and psychological basics of user experience. ▪ understand the emotional impact of design and typography and apply them to specific fields. ▪ apply principles of Emotional Design. ▪ understand developments in the human-machine relationship based on future technologies such as artificial intelligence. ▪ understand and apply aspects of user experience design. **Human Computer Interaction** On successful completion, students will be able to ▪ understand the human basics of perception, information processing, cognition, and motor skills in order to apply them for a user-friendly design of user interfaces. ▪ understand technical frameworks in the design of user interfaces. ▪ know and analyze current trends in human-computer interaction.

Links to other Modules within the Study Program	Links to other Study Programs of IU International University of Applied Sciences
This module is similar to other modules in the fields Psychology and Computer Science & Software Development	All Bachelor Programs in the Social Sciences and IT & Technology fields

Experience Psychology

Course Code: DLBUXEP01_E

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

Course Description

The aim is to teach students the psychological and physiological principles of humans, which are of great importance for the design of digital products and services. First, an overview of the psychological aspects of user experience is given. In addition to emotions, motives and personality traits, the functions of the brain are also discussed. Furthermore, the course teaches the emotional effect that can be created through the use of images, colors and shapes as well as typography. Principles of Emotional Design are taught. In addition, the effect of future technologies such as artificial intelligence in the human-machine relationship will be discussed. A final focus will be placed on design and its importance for user experience.

Course Outcomes

On successful completion, students will be able to

- outline physiological and psychological basics of user experience.
- understand the emotional impact of design and typography and apply them to specific fields.
- apply principles of Emotional Design.
- understand developments in the human-machine relationship based on future technologies such as artificial intelligence.
- understand and apply aspects of user experience design.

Contents

1. Basics and Explanations of Terms
   - 1.1 Explanation of terms
   - 1.2 User Experience over Time
   - 1.3 Interaction of Psychology and Design

2. How "Experience" Works in the Brain
   - 2.1 Anatomy of the Human Brain
   - 2.2 Limbic System
   - 2.3 Main Components of a Nerve Cell
   - 2.4 Brain Research and Marketing Myths

Literature
Compulsory Reading
Further Reading ▪ Evans, D. C. (2017): Bottlenecks: Aligning UX Design with User Psychology. Apress, Springer Science + Business, New York. ▪ Kahneman, D. (2011): Thinking, fast and slow. Penguin Books, London. ▪ Norman, D. (2013): The design of everyday things. Revised and expanded edition. Basic Books, New York. ▪ Turner, P. (2017): A Psychology of User Experience. Human Computer Interaction Series. Springer International Publishing, Cham/Switzerland.

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	

Human Computer Interaction

Course Code: DLBUXHCI01_E

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

Course Description

The objective of this course is to teach students fundamental aspects of interaction between humans and computers. For a user-friendly design of interfaces on computers, machines and devices, a precise knowledge of human abilities and skills is necessary. The main focus of the course is on teaching the basics of human information processing. Special attention is paid to the physiological and psychological aspects of perception, cognition and motor skills. In addition to basics from a human perspective, the technical conditions for the machine perspective will be introduced. Finally, trends in human-computer interaction will be discussed.

Course Outcomes

On successful completion, students will be able to

- understand the human basics of perception, information processing, cognition, and motor skills in order to apply them for a user-friendly design of user interfaces.
- understand technical frameworks in the design of user interfaces.
- know and analyze current trends in human-computer interaction.

Contents

1. Fundamentals of Human-Computer Interaction
   - 1.1 Definitions
   - 1.2 Challenges in Human Computer Interaction
   - 1.3 Basic Models of Human Information Processing

2. Perception
   - 2.1 Sight and Visual Perception
   - 2.2 „Gestaltpsychology“ laws
   - 2.3 Attentive and Preattentive Perception
   - 2.4 Auditory Sense and Auditory Perception
   - 2.5 Sense of Touch and Proprioception
   - 2.6 Smell and Taste Perception

3. Cognition, Motor Skills
   - 3.1 Memory Types and Cognitive Processes
   - 3.2 Stress due to Multiple Tasks
   - 3.3 Measuring Cognitive Load
   - 3.4 Decision Making and Speed
   - 3.5 Motor Skills

4. Mental Models and Errors
   - 4.1 Mental Models
   - 4.2 User Error
   - 4.3 Basic Types of Errors
   - 4.4 Murphy's Law

5. Technical Framework
   - 5.1 Visual Representation and Spatial Resolution
   - 5.2 Time Resolution
   - 5.3 Representation of Color and Brightness
   - 5.4 Acoustic Representation
   - 5.5 Moore's Law

6. Aspects of the Interaction with Socio-Technical systems
   - 6.1 Overview of Interaction Styles
   - 6.2 Acceptance
   - 6.3 Trust
   - 6.4 Security and Data Protection

7. Trends in Human-Computer Interaction
   - 7.1 Intelligent Systems
   - 7.2 Ubiquitous Computing
   - 7.3 Augmented Reality
   - 7.4 Multimodal Interaction
   - 7.5 Haptics

Literature
Compulsory Reading
Further Reading ▪ Sharp, H./Preece, J./Rogers, Y. (2019): Interaction Design: Beyond Human-Computer Interaction. 5. Auflage, John Wiley & Sons, Indianapolis. ▪ Shneiderman, B./Plaisant, C./Cohen, M./Jacobs, S./Elmqvist, N./Diakopoulos, N. (2017): Designing the User Interface: Strategies for Effective Human-Computer Interaction. 6. Auflage, Pearson, Harlow. ▪ Stanton, N./Salmon, P.M./Rafferty, L.A./Walker, F.H./Baber, Ch./Jenkins, D.P.. (2017): Human ▪ Factors Methods: A Practical Guide for Engineering and Design. 2. Auflage, CRC Press Taylor & Francis Group, Boca Raton

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

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** <u>Self-Driving Vehicles</u> • Study Format "Distance Learning": Exam, 90 Minutes (50) <u>Seminar: Current Topics and Trends in Self-Driving Technology</u> • 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 This module is similar to other modules in the field of Engineering	**Links to other Study Programs of IU International University of Applied Sciences** 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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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

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 "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes (50) Automation and Robotics • Study Format "Distance Learning": Exam, 90 Minutes (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 IU International University of Applied Sciences
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. Classification Of Manufacturing Processes
   - 2.1 Casting and Molding
   - 2.2 Forming
   - 2.3 Machining
   - 2.4 Joining
   - 2.5 Coating
   - 2.6 Changing the Properties of Substances

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

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

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

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

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

Literature
Compulsory Reading
Further Reading ▪ Anderson, C. (2012): Makers. The new industrial revolution. Crown Business, New York. ▪ Gebhardt, A. (2012): Understanding Additive Manufacturing. Rapid Prototyping – Rapid Tooling – Rapid Manufacturing. Hanser, München/Cincinnati. ▪ Gibson, I., Rosen, D., Stucker, B., & Khorasani, M. (2021). Additive Manufacturing Technologies (3rd ed.). Springer International Publishing. ▪ Groover, M. P., (2019). Fundamentals of Modern Manufacturing: Materials, Processes, and Systems (7th ed.). Wiley. ▪ Kalpakjian, S., & Schmid, S.R. (2020). Manufacturing Engineering and Technology (8th ed.). Pearson.

Study Format myStudies

Study Format	Course Type
myStudies	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	

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

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

- Czichos, H. (2018). Measurement, testing and sensor technology: Fundamentals and application to materials and technical systems. Springer International Publishing.
- Jazar, R. N. (2010). Theory of Applied Robotics (2. Auflage): Springer US, Boston.
- Manesis, S., & Nikolakopoulos, G. (2020). Introduction to industrial automation. CRC Press, Taylor & Francis Group.
- Nise, N. S. (2019). Control systems engineering (8th ed.). Wiley.
- Siciliano, B., Sciavicco, L., Villani, L., & Oriolo, G. (2009). Robotics - Modeling, Planning and Control. Springer London.
- Singh, K. K., Nayyar, A., Tanwar, S., & Abouhawwash, M. (2021). Emergence of Cyber Physical System and IoT in Smart Automation and Robotics. Springer International 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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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 IU International University of Applied Sciences
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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed

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®
- ☐ Course Book
- ☐ Vodcast
- ☐ Shortcast
- ☐ Audio
- ☐ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☑ Guideline
- ☑ Live Tutorium/Course Feed

Digital Signal Processing and Sensor Technology

Module Code: DLBAIEDSPST

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. (Digital Signal Processing) / Prof. Dr. Matthias Eifler (Sensor Technology)

Contributing Courses to Module
▪ Digital Signal Processing (DLBROEICR01_E) ▪ Sensor Technology (DLBROST01_E)

Module Exam Type	
Module Exam	**Split Exam** Digital Signal Processing • Study Format "Distance Learning": Exam, 90 Minutes (50) Sensor Technology • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes
Weight of Module see curriculum	

Module Contents	
Digital Signal Processing ▪ Signal sampling and quantization ▪ Digital signals and systems ▪ Discrete Fourier Transform ▪ z-Transform ▪ Digital signal processing and filters **Sensor Technology** ▪ Sensors and transducers ▪ Resistive, capacitive, inductive, optical and acoustic sensor effects ▪ Transduction platforms and sensor systems ▪ Applications ▪ Advanced sensors	
Learning Outcomes **Digital Signal Processing** On successful completion, students will be able to ▪ analyze discrete time systems. ▪ apply analysis tools such as the Discrete Fourier Transform. ▪ apply the z-Transform. ▪ analyze properties of discrete systems. ▪ design finite and infinite impulse response filters. ▪ implement filters in hardware and software. **Sensor Technology** On successful completion, students will be able to ▪ understand the main sensor characteristics. ▪ read and understand a typical sensor data sheet. ▪ understand sensor effects. ▪ understand and characterize sensor platforms. ▪ select the appropriate sensor technology for a given application.	
Links to other Modules within the Study Program This module is similar to other modules in the field of Engineering	**Links to other Study Programs of IU International University of Applied Sciences** All Bachelor Programs in the IT & Technology fields

Digital Signal Processing

Course Code: DLBROEICR01_E

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

Course Description

Digital signal processing enables digital audio and video extraction, as well as extraction of important features from any other kind of signal, for instance medial imagery or diagnostic tools. This course provides the students with expertise on the theory and practice of digital signal processing. In the first part, theoretical concepts are introduced, presenting the main tools for analysis of digital, i.e., sampled or discrete-time systems. The core of digital signal processing resides in the design of a digital filter. The second part of the course focuses on different filter-design approaches, i.e. a discussion on finite impulse response and infinite impulse response filters. The last part gives important insights into the hardware and software implementation of digital signal processing, bridging theory with applied practice.

Course Outcomes

On successful completion, students will be able to

- analyze discrete time systems.
- apply analysis tools such as the Discrete Fourier Transform.
- apply the z-Transform.
- analyze properties of discrete systems.
- design finite and infinite impulse response filters.
- implement filters in hardware and software.

Contents

1. Introduction
   - 1.1 Basic Concepts
   - 1.2 Applications

2. Signal Sampling and Quantization
   - 2.1 Sampling
   - 2.2 Signal reconstruction
   - 2.3 Analog-to-digital Conversion
   - 2.4 Digital-to-Analog Conversion
   - 2.5 Quantization

3. Digital Signals and Systems
   - 3.1 Digital Signals
   - 3.2 Difference Equations and Impulse Responses
   - 3.3 BIBO-Stability
   - 3.4 Digital Convolution

4. Discrete Fourier Transform
   - 4.1 Discrete Fourier Transform
   - 4.2 Amplitude and Power Spectrum
   - 4.3 Spectral Estimation

5. The z-Transform
   - 5.1 Definition
   - 5.2 Properties
   - 5.3 Inverse z-Transform
   - 5.4 Solution of Difference Equations

6. Digital Signal Processing Systems and Filters
   - 6.1 Difference Equation and Transfer Function
   - 6.2 Poles, Zeros and Stability
   - 6.3 Digital Filter Frequency Response
   - 6.4 Basic Filtering
   - 6.5 Realization of Digital Filters
   - 6.6 Applications

7. Finite Impulse Response Filter Design
   - 7.1 Basics
   - 7.2 Fourier Transform Design
   - 7.3 Window Method
   - 7.4 Frequency Sampling Design Method
   - 7.5 Optimal Design Method
   - 7.6 Applications

8. Infinite Impulse Response Filter Design
    - 8.1 Basics
    - 8.2 Bilinear Transformation Design Method
    - 8.3 Butterworth and Chebyschev Filter Designs
    - 8.4 Higher-Order Infinite Impulse Response Filter Design
    - 8.5 Pole-Zero Placement for Simple Filters
    - 8.6 Applications

9. Hardware and Software for Digital Signal Processing
    - 9.1 Digital Signal Processor Architecture
    - 9.2 Digital Signal Processor Hardware Units
    - 9.3 Fixed-Point and Floating-Point Formats
    - 9.4 Implementation of FIR and IIR Filters in Fixed-Point
    - 9.5 DSP Programming Examples

Literature

Compulsory Reading

Further Reading

- Manolakis, D. G./Ingle, V. K. (2011): Applied digital signal processing: theory and practice. Cambridge University Press, Cambridge.
- Tan, L./Jiang, J. (2013): Digital signal processing: fundamentals and applications. 2nd ed., Academic Press, Cambridge, MS.
- Vetterli, M./Kovačević, J./Goyal, V. K. (2014): Foundations of signal processing. 2nd ed., Cambridge University Press, Cambridge.

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

Sensor Technology

Course Code: DLBROST01_E

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Introduction to Measurement Uncertainty
   - 1.1 Measurement Uncertainty
   - 1.2 Confidence Intervals
   - 1.3 Expression of Uncertainty

2. Sensors
   - 2.1 Sensors and Transducers
   - 2.2 Selection of Sensors
   - 2.3 Sensor Characteristics
   - 2.4 Measurement Systems and Components

3. Resistive Sensors
    3.1 Resistivity and Resistance
    3.2 Potentiometric Sensors
    3.3 Strain Gauges
    3.4 Piezoresistive Sensors
    3.5 Magnetoresistive Sensors
    3.6 Thermoresistive Sensors
    3.7 Optoresistive Sensors

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

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

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

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

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

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

Literature

Compulsory Reading

Further Reading

- Kalantar-Zadeh, K. (2013): Sensors: An Introductory Course. Springer US, New York, NY.
- Lin, Y. L. et al (eds.) (2015): Smart Sensors and Systems. Springer International Publishing, Cham.
- Mukhopadhyay, S. C. (ed.) (2016): Next Generation Sensors and Systems. In: Smart Sensors, Measurement and Instrumentation, Vol. 16. Springer International Publishing, Cham.
- Regtien, P./Dertien, E. (2018): Sensors for Mechatronics. 2nd ed., Elsevier, Amsterdam.

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

DLBROST01_E

Database Developer

Module Code: DLBAIEDD

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. Ralf Kneuper (Database Modeling and Database Systems) / Sharam Dadashnia (Project: Build a Data Mart in SQL)

Contributing Courses to Module
▪ Database Modeling and Database Systems (DLBCSDMDS01) ▪ Project: Build a Data Mart in SQL (DLBDSPBDM01)

Module Exam Type	
Module Exam	**Split Exam** Database Modeling and Database Systems • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Project: Build a Data Mart in SQL • Study Format "Distance Learning": Portfolio • Study Format "myStudies": Portfolio
Weight of Module see curriculum	

Module Contents

Database Modeling and Database Systems

- 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

Project: Build a Data Mart in SQL

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

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.

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 IU International University of Applied Sciences
This module is similar to other modules in the fields of Data Science & Artificial Intelligence	All Bachelor Programs in the IT & Technology fields

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

- 46th VLDB (2020). Proceedings of the International Conference on Very Large Data Bases (VLDB).
- Date, C.J. (2019). Database design and relational theory: Normal forms and all that jazz (2nd ed.). Apress.
- Documentation of Mondial Database (2010). Mondial Database.
- Elmasri, R., Navathe, S. B. (2016). Fundamentals of database systems. Pearson Education Limited.
- Foster, E., Godbole, S. (2016). Database systems. A pragmatic approach. (2nd ed.). Apress.
- Sumathi, S. et al (2010). Fundamentals of relational database management systems. Springer.
- W3Schools (2020). SQL Tutorial.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

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

Study Format myStudies

Study Format myStudies	**Course Type** 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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☑ Live Tutorium/Course Feed

Business Intelligence

Module Code: DLBCSEBI

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

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

Module Coordinator

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

Contributing Courses to Module

- Business Intelligence (DLBCSEBI01)
- Project: Business Intelligence (DLBCSEBI02)

Module Exam Type

Module Exam	Split Exam
	Business Intelligence • Study Format "Distance Learning": Exam, 90 Minutes Project: Business Intelligence • Study Format "Distance Learning": Written Assessment: Project Report

Weight of Module

see curriculum

Module Contents
Business Intelligence ▪ Basics of mobile software development ▪ Android system architecture ▪ Development environment ▪ Core components of an Android app ▪ Interaction between application components ▪ Advanced techniques **Project: Business Intelligence** Conception, implementation, and documentation of small, mobile applications on the basis of a concrete task.

Learning Outcomes
Business Intelligence On successful completion, students will be able to ▪ explain the motivation, use cases, and basics of Business Intelligence. ▪ identify and explain techniques and methods for providing and modeling data, as well as types of data relevant to BI, differentiating between them. ▪ explain techniques and methods for the generation and storage of information and independently select suitable methods on the basis of concrete requirements. **Project: Business Intelligence** On successful completion, students will be able to ▪ independently design a solution to a practical problem in the field of Business Intelligence in order to then implement a prototype and document the results. ▪ identify and explain typical problems and challenges in the design and practical implementation of small BI solutions.

Links to other Modules within the Study Program	Links to other Study Programs of IU International University of Applied Sciences
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

Literature

Compulsory Reading

Further Reading

- Grossmann, W., & Rinderle-Ma, S. (2015). Fundamentals of business intelligence. Springer.
- Kolb, J. (2013). Business intelligence in plain language: A practical guide to data mining and business analytics. Createspace.
- Sharda, R., Delen, D., & Turban, E. (2014). Business intelligence and analytics: Systems for decision support. Pearson.
- Sherman, R. (2014). Business intelligence guidebook: From data integration to analytics. Morgan Kaufmann.
- Vaisman, A., & Zimányi, E. (2016). Data warehouse systems: Design and implementation. 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	

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

- Christoph Meinel, Hasso Plattner, Larry Leifer (2011): Design Thinking: Understand – Improve – Apply; Springer Berlin Heidelberg
- Jeanne Liedtka (2018): Why Design Thinking Works. In: Havard Business Review, Issue: 2018/09, pp.72–79
- Christoph Meinel, Larry J. Leifer (2021): Design Thinking Research: Interrogating the Doing; Springer International 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	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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☑ Guideline ☐ Live Tutorium/Course Feed

DLBCSEBI02

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** <u>Advanced Data Analysis</u> • Study Format "Distance Learning": Exam, 90 Minutes <u>Project: Data Analysis</u> • Study Format "Distance Learning": Portfolio
Weight of Module see curriculum	

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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.

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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

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Links to other Modules within the Study Program

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

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Links to other Study Programs of IU International University of Applied Sciences

All Bachelor Programmes in the IT & Technology fields

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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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☐ Live Tutorium/Course Feed

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

Augmented, Mixed and Virtual Reality

Module Code: DLBMIAMVR_E

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

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

Module Coordinator
N.N. (Augmented, Mixed and Virtual Reality) / N.N. (X-Reality Project)

Contributing Courses to Module
▪ Augmented, Mixed and Virtual Reality (DLBMIAMVR01_E) ▪ X-Reality Project (DLBMIAMVR02_E)

Module Exam Type	
Module Exam	**Split Exam** Augmented, Mixed and Virtual Reality • Study Format "Distance Learning": Exam, 90 Minutes X-Reality Project • Study Format "Distance Learning": Written Assessment: Project Report
Weight of Module see curriculum	

Module Contents

Augmented, Mixed and Virtual Reality

- Definition and Differentiation of Terms
- Fields of Application and Examples
- Aspects of Human Perception
- Augmented and Virtual Reality Output Devices
- Input Devices
- Interaction in Virtual and Augmented Realities
- Aspects of XR Application Development
- Future of XR Technologies

X-Reality Project

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

Learning Outcomes

Augmented, Mixed and Virtual Reality

On successful completion, students will be able to

- name the characteristics and differences of augmented, mixed, and virtual reality techniques.
- describe the importance of sensual perception in AR and VR.
- explain the basic technical features of AR and VR systems.
- explain the different interaction possibilities in AR and VR applications.
- perform selected development processes for AR and VR applications.

X-Reality Project

On successful completion, students will be able to

- implement a small AR/VR application by themselves.
- experiment with the concept of AR/VR applications.
- discuss challenges and issues in AR/VR software development.
- document the concept and implementation of independently developed AR/VR applications and accumulated experience in a project report.

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

Augmented, Mixed and Virtual Reality

Course Code: DLBMIAMVR01_E

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

Course Description

Augmented, mixed and virtual reality (AR, MR and VR) technologies are becoming increasingly important in a wide range of application areas. In this context, novel hardware devices and forms of interaction are used. In addition to the technical foundations, this course covers aspects of human perception and approaches for developing AR/VR applications. To give the students a knowledge of the field, the terms augmented, mixed, and virtual reality will be defined and differentiated and examples of their use will be demonstrated. In order to simulate the existence of a virtual world or virtual objects to users, aspects of human perception have to be used. Based on the fundamentals of human information processing, the course highlights the phenomena, problems, and solutions that have to be considered in AR and VR applications. AR and VR systems can be implemented in different ways. This course addresses different output forms, tracking methods and interaction possibilities. In addition, other techniques that are specifically relevant in the AR field will be represented. Software development in the AR and VR field may require the application of special processes. This course teaches selected approaches that are helpful in designing, prototyping, and testing AR and VR applications. The course concludes with a view at the future applications and the research potential of augmented, mixed, and virtual reality.

Course Outcomes

On successful completion, students will be able to

- name the characteristics and differences of augmented, mixed, and virtual reality techniques.
- describe the importance of sensual perception in AR and VR.
- explain the basic technical features of AR and VR systems.
- explain the different interaction possibilities in AR and VR applications.
- perform selected development processes for AR and VR applications.

Contents

1. Introduction to Augmented, Mixed and Virtual Reality
   1.1 Definition and Differentiation of Terms
   1.2 Fields of Application and Examples

8. The Future of Augmented, Mixed and Virtual Reality
   - 8.1 Outlook on Future Applications
   - 8.2 Focus Points for Future Research

Literature

Compulsory Reading

Further Reading

- Billinghurst, M./Clark, A./Lee, G.: "A Survey of Augmented Reality". In: Foundations and Trends in Human-Computer Interaction, Vol. 8, Nr. 2-3, S.73-272.
- Jerald, J. (2016): The VR Book. Human-Centered Design for Virtual Reality. ACM und Morgan & Claypool.
- Schmalstieg, D./Höllerer, T. (2016): Augmented Reality. Principles and Practice. Addison-Wesley.

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

X-Reality Project

Course Code: DLBMIAMVR02_E

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

Course Description

The students create an application from the field of augmented or virtual reality by themselves and document its conception and implementation as well as collected experiences. The development of an AR/VR application may include special steps that are not known from classic software applications. In this context, AR- or VR-typical elements of the application should be explicitly highlighted and challenges and problems should be addressed.

Course Outcomes

On successful completion, students will be able to

- implement a small AR/VR application by themselves.
- experiment with the concept of AR/VR applications.
- discuss challenges and issues in AR/VR software development.
- document the concept and implementation of independently developed AR/VR applications and accumulated experience in a project report.

Contents

- The students work on a project from the field of augmented or virtual reality. They design and implement an AR/VR application based on a concrete task. The development of the application as well as collected experiences are documented in a project report. The project report first presents the project goal as well as the topic and context of the application. Then the requirements, the conception and the implementation of the application are described. During the documentation, AR- or VR-typical elements will be explicitly highlighted. The report concludes by highlighting the challenges and issues that arose during development.

Literature

Compulsory Reading

Further Reading

- Buttfield-Addison, P., Manning, J., Nugent, T. (2019): Unity Game Development Cookbook: Essentials for Every Game. O'Reilly.
- Linowes, J. (2015): Unity virtual reality projects. Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D. Packt Publishing.
- Linowes, J./Babilinski, K. (2017): Augmented Reality for Developers. Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt Publishing.

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Project

Information about the examination	
Examination Admission Requirements	**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	

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 "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes International Brand Management • Study Format "myStudies": Exam, 90 Minutes • 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 IU International University of Applied Sciences
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

Literature
Compulsory Reading
Further Reading ▪ Armstrong, G., Kotler, P., & Opresnik, M. O. (2019). Marketing: An introduction (14th ed.). Pearson. ▪ Green, M. C., & Keegan, W. J. (2020). Global marketing (10th ed.). Pearson. ▪ Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). Cultures and organizations—Software of the mind: Intercultural cooperation and its importance for survival. McGraw-Hill. ▪ Hollensen, S. (2020). Global marketing (8th ed.). Pearson. ▪ Mooij, M. (2018). Global marketing and advertising: Understanding cultural paradoxes (5th ed.). Sage Publications.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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 Hierarchies
   - 5.2 Co-branding and Ingredient Branding

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

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

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

9. Brand Control
   - 9.1 Basics of Brand Controlling
   - 9.2 Importance and Measurement of Brand Value (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

- Gelder, S. v. (2003): Global Brand Strategy. Unlocking Brand Potential Across Countries, Cultures and Markets. Kogan Page, London.
- Keller, K. L. (2007): Strategic Brand Management. Building, Measuring and Managing Brand Equity. 3. Auflage, Prentice Hall International, Edinburgh.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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 This module is similar to other modules in the fields of Marketing & Sales	**Links to other Study Programs of IU International University of Applied Sciences** 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

Literature

Compulsory Reading

Further Reading

- Jobber, D./Lancaster, G./Le Meunier-Fitzhugh, K. (2019): Selling and Sales Management, 11th Ed.; Pearson
- Johnston, M.W./Marshall (2021): Sales Force Management: Leadership, Innovation, Technology; Routledge
- Jordan, J./Vazzana, M. (2011): Cracking the Sales Management Code: The Secrets to Measuring and Managing Sales Performance; 13th Ed.; McGraw Hill
- Kumar, V./Reinartz, W. (2018): Customer Relationship Management: Concept, Strategy, and Tools; 3rd Ed.; Springer Texts in Business and Economics
- Marcos, J./Davies, M. (2019): Implementing Key Account Management: Designing Customer-Centric Processes for Mutual Growth; KoganPage
- Peppers, D./Rogers, M. (2011): Managing Customer Relationships : A Strategic Framework; 2nd Ed.; 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

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

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

- Jobber, D./Lancaster, G./Le Meunier-Fitzhugh, K. (2019): Selling and Sales Management, 11th Ed.; Pearson
- Johnston, M.W./Marshall (2021): Sales Force Management: Leadership, Innovation, Technology; Routledge
- Jordan, J./Vazzana, M. (2011): Cracking the Sales Management Code: The Secrets to Measuring and Managing Sales Performance; 13th Ed.; McGraw Hill
- Kumar, V./Reinartz, W. (2018): Customer Relationship Management: Concept, Strategy, and Tools; 3rd Ed.; Springer Texts in Business and Economics
- Marcos, J./Davies, M. (2019): Implementing Key Account Management: Designing Customer-Centric Processes for Mutual Growth; KoganPage
- Peppers, D./Rogers, M. (2011): Managing Customer Relationships : A Strategic Framework; 2nd Ed.; 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

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

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

Prof. Dr. Hubert Vogl (Supply Chain Management I) / N.N. (Supply Chain Management II)

Contributing Courses to Module

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

Module Exam Type

Module Exam	Split Exam
	Supply Chain Management I • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes Supply Chain Management II • Study Format "myStudies": Exam, 90 Minutes • Study Format "Distance Learning": Exam, 90 Minutes (-)

Weight of Module

see curriculum

Module Contents

Supply Chain Management I

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

Supply Chain Management II

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

Learning Outcomes

Supply Chain Management I

On successful completion, students will be able to

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

Supply Chain Management II

On successful completion, students will be able to

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

Links to other Modules within the Study Program	**Links to other Study Programs of IU International University of Applied Sciences**
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

2. Selected Theoretical Concepts for the Supply Chain Concept
   - 2.1 New Institutional Economics
   - 2.2 Game Theory
   - 2.3 Network Approach
   - 2.4 Other Theoretical Additions

3. Supply Chain Management
   - 3.1 Basic Information on the Goals and Scope of SCM
   - 3.2 Popular Problem Areas of the SCM
   - 3.3 Supply Chain Management as an Evolutionary Step in Logistics
   - 3.4 Supply Chain Management as Cooperation Management

4. SCM Model
   - 4.1 Basic Information on the Term SCM Models
   - 4.2 SCOR Model
   - 4.3 SCM Task Model

5. SCM as a Coordination Problem
   - 5.1 Basic Information on the Concept of Coordination
   - 5.2 Coordination Concepts, Context, and Perspectives of SCM
   - 5.3 Coordination Instruments

Literature
Compulsory Reading
Further Reading

Further Reading

- Bookbinder, J. H. (2013). Handbook of global logistics: Transportation in international supply chains. International series in operations research & management science: Bd. 181. Springer.
- Chopra, S (2019). Supply Chain Management: Strategy, Planning, and Operation, EBook, Global Edition, Pearson Education, Limited. ProQuest Ebook Central.
- Chopra, S. & Meindl, P. (2016). Supply chain management: Strategy, planning, and operation. Always learning. Pearson.
- Christopher, M. (2016). Logistics & supply chain management (Fifth edition). Pearson.
- Ganesan, R. (2015). The profitable supply chain: A practitioner's guide. Apress.
- Grant, D. B. (2012). Logistics management. Pearson.
- Kurbel, K. (2013). Enterprise resource planning and supply chain management: Functions, business processes and software for manufacturing companies. Progress in IS. Springer.
- Pawar, K. S., Rogers, H., Potter, A. & Naim, M. (2015). Developments in Logistics and Supply Chain Management: Past, Present and Future. Palgrave Macmillan.
- Piotrowicz, W. & Cuthbertson, R. (Hrsg.). (2015). Supply chain design and management for emerging markets: Learning from countries and regions. Springer International Publishing.
- Scott, C., Lundgren, H. & Thompson, P. (2018). Guide to Supply Chain Management: An end to end perspective. Management for professionals. Springer.
- Sindi, S. & Roe, M. (2017). Strategic supply chain management: The development of a diagnostic model. Palgrave Macmillan.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

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	

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

- Bookbinder, J. H. (2013). Handbook of global logistics: Transportation in international supply chains. International series in operations research & management science: Bd. 181. Springer.
- Chopra, S (2019). Supply Chain Management: Strategy, Planning, and Operation, EBook, Global Edition, Pearson Education, Limited. ProQuest Ebook Central.
- Chopra, S. & Meindl, P. (2016). Supply chain management: Strategy, planning, and operation. Always learning. Pearson.
- Christopher, M. (2016). Logistics & supply chain management (Fifth edition). Pearson.
- Ganesan, R. (2015). The profitable supply chain: A practitioner's guide. Apress.
- Grant, D. B. (2012). Logistics management. Pearson.
- Kurbel, K. (2013). Enterprise resource planning and supply chain management: Functions, business processes and software for manufacturing companies. Progress in IS. Springer.
- Pawar, K. S., Rogers, H., Potter, A. & Naim, M. (2015). Developments in Logistics and Supply Chain Management: Past, Present and Future. Palgrave Macmillan.
- Piotrowicz, W. & Cuthbertson, R. (Hrsg.). (2015). Supply chain design and management for emerging markets: Learning from countries and regions. Springer International Publishing.
- Scott, C., Lundgren, H. & Thompson, P. (2018). Guide to Supply Chain Management: An end to end perspective. Management for professionals. Springer.
- Sindi, S. & Roe, M. (2017). Strategic supply chain management: The development of a diagnostic model. Palgrave Macmillan.

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☑ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☐ Live Tutorium/Course Feed

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": Exam Financial Services Management II • Study Format "Distance Learning": Exam
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 IU International University of Applied Sciences
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
2. Financial Intermediation
   - 2.1 The Banking System
   - 2.2 Asset Management Companies and Insurance Companies
   - 2.3 Regulations and Supervision
3. Financial Services
   - 3.1 Financing Needs
   - 3.2 The Range of Financial Services

4. Debt Financing Through Financial Intermediaries
   - 4.1 Types of Loans
   - 4.2 Lending and Collateralization
   - 4.3 Credit Substitutes

5. Equity Financing Through Financial Intermediaries
   - 5.1 Equity Financing Through Capital Participation and Venture Financing Companies
   - 5.2 Equity Capital Markets Issuance
   - 5.3 Disintermediation in Finance

Literature

Compulsory Reading

Further Reading

- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10th edition, McGraw-Hill, London.
- Rose, P.; Hudgins, S. (2012): Bank Management & Financial Services. 9th edition. McGraw-Hill.
- Titman, S., Keown, A.J., Martin, J. D. (2016): Financial Management: Principles and Applications. 13th edition, Pearson, New York.

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	☐ Reader
☑ Exam Template	☐ Slides

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
   3.4 Other Tangible Assets

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

- Brealey, R. A./Myers, S. C. (2010): Principles of Corporate Finance. 10th edition, McGraw-Hill, London.
- Rose, P.; Hudgins, S. (2012): Bank Management & Financial Services. 9th edition. McGraw-Hill.
- Titman, S., Keown, A.J., Martin, J. D. (2016): Financial Management: Principles and Applications. 13th edition, Pearson, New York.

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	☐ Reader
☑ Exam Template	☐ Slides

IT project and architecture management

Module Code: DLBCSEITPAM

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. (IT Project Management) / Prof. Dr. Tobias Brückmann (IT Architecture Management)

Contributing Courses to Module
▪ IT Project Management (DLBCSEITPAM01) ▪ IT Architecture Management (DLBCSEITPAM02)

Module Exam Type	
Module Exam	**Split Exam** <u>IT Project Management</u> • Study Format "Distance Learning": Exam, 90 Minutes • Study Format "myStudies": Exam, 90 Minutes <u>IT Architecture Management</u> • Study Format "Distance Learning": Exam, 90 Minutes
Weight of Module see curriculum	

Module Contents
IT Project Management ▪ Basic terms and foundations of IT project management ▪ Large and small planning techniques ▪ Techniques for prioritization, cost-estimation, and project controlling ▪ Techniques for stakeholder, communication, and risk management ▪ Organization and structure in IT project management ▪ Schools of thought in IT project management **IT Architecture Management** ▪ Basic terms and foundations of IT enterprise architectures management ▪ IT application portfolio management ▪ Architecture governance ▪ Modeling of IT enterprise architectures ▪ Frameworks using TOGAF as an example ▪ Reference models and sample catalogues
Learning Outcomes
IT Project Management On successful completion, students will be able to ▪ explain and differentiate between the basic principles and tasks of IT project management. ▪ explain the important practical techniques and methods necessary for the implementation of IT project management. ▪ describe the basic procedural models and explain their advantages and disadvantages as well as their possible applications. ▪ identify possible project risks on the basis of given practical scenarios and select suitable measures from IT project management in order to minimize them in a targeted manner. **IT Architecture Management** On successful completion, students will be able to ▪ describe and explain the basic principles of IT strategy, governance, and architecture management, differentiating between them. ▪ explain and differentiate the typical activities of IT architecture management, their interrelationships, and their dependencies. ▪ explain suitable models of IT architecture management, distinguish between them, and explain their intended purpose. ▪ explain and describe selected IT architectural frameworks as well as reference models and sample catalogues.

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

IT Project Management

Course Code: DLBCSEITPAM01

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Basics Terms and Foundations of IT Project Management
   - 1.1 Definition of a Project and Types of IT Projects
   - 1.2 IT Project Lifecycle
   - 1.3 Multi-Project Management – The Project in the Context of the Organization

2. Planning Techniques
   - 2.1 Large-Scale Planning: Milestones, Sub-tasks, and Work Packages
   - 2.2 Large-Scale Planning: Gantt Charts
   - 2.3 Planning and Organization of Work Packages: Kanban Board

3. Prioritization, Estimation of Costs, Project Controlling
   - 3.1 Prioritization
   - 3.2 Estimation of Costs
   - 3.3 Project Controlling

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

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

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

Literature

Compulsory Reading

Further Reading

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Project Management Institute (2017). Newtown Square, PA, USA, 6th Ed., 589 pages.
- IPMA Individual Competence Baseline for Project, Programme & Portfolio Management International Project Management Association (2015). 4th Ed., 416 pages.
- IPMA Organisational Competence Baseline International Project Management Association (2016). 112 pages.
- Nexus™ Guide Schwaber, K. (2015). Scrum.org, Boston, MA, USA, 11 pages.
- Phillips, J. (2010): IT Project Management. On Track from Start to Finish. 3. Auflage, McGraw-Hill, New York, NY.
- Project Management: A Systems Approach to Planning, Scheduling, and Controlling Kerzner, H. (2017). Wiley & Sons, Hoboken, NJ, USA, 12th Ed., 848 pages.
- Project Management: A Managerial Approach Meredith, J.R., Mantel, S.J. (2015). Wiley & Sons, Hoboken, NJ, USA, 9th Ed., 512 pages.
- Schwalbe, K. (2010): Information Technology Project Management. 6. Auflage, Course Technology, Independence, KY.
- The Scrum Guide™ Schwaber, K., Sutherland (2013). Scrum.org, Boston, MA, USA, 16 pages.
- The Mythical Man Month Fred Brooks, JR (1975). Addison.Wesley

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	

Study Format myStudies

Study Format	Course Type
myStudies	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® ☑ Course Book ☐ Vodcast ☑ Shortcast ☑ Audio ☑ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☑ Live Tutorium/Course Feed

IT Architecture Management

Course Code: DLBCSEITPAM02

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

Course Description

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

Course Outcomes

On successful completion, students will be able to

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

Contents

1. Basic Terms and Foundation for the Management of IT Enterprise Architectures
   - 1.1 IT Enterprise Architecture
   - 1.2 Goals of Enterprise Architecture Management
   - 1.3 Processes in the Management of IT Enterprise Architectures

2. IT Application Portfolio Management
   - 2.1 IT Application Portfolio Management Overview
   - 2.2 Application Manual
   - 2.3 Portfolio Analysis
   - 2.4 Development Planning

3. Architecture Governance
    3.1 Organizational Structure
    3.2 Policy Development and Enforcement
    3.3 Project Support

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

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

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

Literature

Compulsory Reading

Further Reading

- Bernard, S. A. (2020): An Introduction to holistic Enterprise Architecture: Fourth Edition, AuthorHouse, 4th Edition, 322 pages.
- G. R&A (2015): Chess and the Art of Enterprise Architecture Wierda, 252 pages
- Ross, J. W./ Weill, P./Robertson, D. C. (2006): Enterprise Architecture as Strategy. Creating a Foundation for Business Execution. Harvard Business Review Press, Boston, 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	

Psychology of Human Computer Interaction

Module Code: DLBKPSWPMCI_E

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

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

Module Coordinator

N.N. (Experience Psychology) / N.N. (Human Computer Interaction)

Contributing Courses to Module

- Experience Psychology (DLBUXEP01_E)
- Human Computer Interaction (DLBUXHCI01_E)

Module Exam Type

Module Exam	Split Exam
	Experience Psychology • Study Format "Distance Learning": Exam, 90 Minutes Human Computer Interaction • Study Format "Distance Learning": Exam, 90 Minutes

Weight of Module

see curriculum

Module Contents	
Experience Psychology ▪ Physiological and Psychological Basics of User Experience ▪ Future Human-Machine Relationships based on Artificial Intelligence ▪ Emotional Impact of Design ▪ User Experience regarding Design Aspects **Human Computer Interaction** ▪ Basics of Human Information Processing ▪ Physiological and Psychological Aspects of Human Perception, Cognition and Behavior ▪ Technical Framework of Human-Computer Interaction ▪ Trends in Human-Computer Interaction	
Learning Outcomes **Experience Psychology** On successful completion, students will be able to ▪ outline physiological and psychological basics of user experience. ▪ understand the emotional impact of design and typography and apply them to specific fields. ▪ apply principles of Emotional Design. ▪ understand developments in the human-machine relationship based on future technologies such as artificial intelligence. ▪ understand and apply aspects of user experience design. **Human Computer Interaction** On successful completion, students will be able to ▪ understand the human basics of perception, information processing, cognition, and motor skills in order to apply them for a user-friendly design of user interfaces. ▪ understand technical frameworks in the design of user interfaces. ▪ know and analyze current trends in human-computer interaction.	
Links to other Modules within the Study Program This module is similar to other modules in the fields Psychology and Computer Science & Software Development	**Links to other Study Programs of IU International University of Applied Sciences** All Bachelor Programs in the Social Sciences and IT & Technology fields

Experience Psychology

Course Code: DLBUXEP01_E

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

Course Description

The aim is to teach students the psychological and physiological principles of humans, which are of great importance for the design of digital products and services. First, an overview of the psychological aspects of user experience is given. In addition to emotions, motives and personality traits, the functions of the brain are also discussed. Furthermore, the course teaches the emotional effect that can be created through the use of images, colors and shapes as well as typography. Principles of Emotional Design are taught. In addition, the effect of future technologies such as artificial intelligence in the human-machine relationship will be discussed. A final focus will be placed on design and its importance for user experience.

Course Outcomes

On successful completion, students will be able to

- outline physiological and psychological basics of user experience.
- understand the emotional impact of design and typography and apply them to specific fields.
- apply principles of Emotional Design.
- understand developments in the human-machine relationship based on future technologies such as artificial intelligence.
- understand and apply aspects of user experience design.

Contents

1. Basics and Explanations of Terms
   - 1.1 Explanation of terms
   - 1.2 User Experience over Time
   - 1.3 Interaction of Psychology and Design

2. How "Experience" Works in the Brain
   - 2.1 Anatomy of the Human Brain
   - 2.2 Limbic System
   - 2.3 Main Components of a Nerve Cell
   - 2.4 Brain Research and Marketing Myths

Literature
Compulsory Reading
Further Reading ▪ Evans, D. C. (2017): Bottlenecks: Aligning UX Design with User Psychology. Apress, Springer Science + Business, New York. ▪ Kahneman, D. (2011): Thinking, fast and slow. Penguin Books, London. ▪ Norman, D. (2013): The design of everyday things. Revised and expanded edition. Basic Books, New York. ▪ Turner, P. (2017): A Psychology of User Experience. Human Computer Interaction Series. Springer International Publishing, Cham/Switzerland.

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

Human Computer Interaction

Course Code: DLBUXHCI01_E

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

Course Description

The objective of this course is to teach students fundamental aspects of interaction between humans and computers. For a user-friendly design of interfaces on computers, machines and devices, a precise knowledge of human abilities and skills is necessary. The main focus of the course is on teaching the basics of human information processing. Special attention is paid to the physiological and psychological aspects of perception, cognition and motor skills. In addition to basics from a human perspective, the technical conditions for the machine perspective will be introduced. Finally, trends in human-computer interaction will be discussed.

Course Outcomes

On successful completion, students will be able to

- understand the human basics of perception, information processing, cognition, and motor skills in order to apply them for a user-friendly design of user interfaces.
- understand technical frameworks in the design of user interfaces.
- know and analyze current trends in human-computer interaction.

Contents

1. Fundamentals of Human-Computer Interaction
   - 1.1 Definitions
   - 1.2 Challenges in Human Computer Interaction
   - 1.3 Basic Models of Human Information Processing

2. Perception
   - 2.1 Sight and Visual Perception
   - 2.2 „Gestaltpsychology“ laws
   - 2.3 Attentive and Preattentive Perception
   - 2.4 Auditory Sense and Auditory Perception
   - 2.5 Sense of Touch and Proprioception
   - 2.6 Smell and Taste Perception

3. Cognition, Motor Skills
   - 3.1 Memory Types and Cognitive Processes
   - 3.2 Stress due to Multiple Tasks
   - 3.3 Measuring Cognitive Load
   - 3.4 Decision Making and Speed
   - 3.5 Motor Skills

4. Mental Models and Errors
   - 4.1 Mental Models
   - 4.2 User Error
   - 4.3 Basic Types of Errors
   - 4.4 Murphy's Law

5. Technical Framework
   - 5.1 Visual Representation and Spatial Resolution
   - 5.2 Time Resolution
   - 5.3 Representation of Color and Brightness
   - 5.4 Acoustic Representation
   - 5.5 Moore's Law

6. Aspects of the Interaction with Socio-Technical systems
   - 6.1 Overview of Interaction Styles
   - 6.2 Acceptance
   - 6.3 Trust
   - 6.4 Security and Data Protection

7. Trends in Human-Computer Interaction
   - 7.1 Intelligent Systems
   - 7.2 Ubiquitous Computing
   - 7.3 Augmented Reality
   - 7.4 Multimodal Interaction
   - 7.5 Haptics

Literature
Compulsory Reading
Further Reading ▪ Sharp, H./Preece, J./Rogers, Y. (2019): Interaction Design: Beyond Human-Computer Interaction. 5. Auflage, John Wiley & Sons, Indianapolis. ▪ Shneiderman, B./Plaisant, C./Cohen, M./Jacobs, S./Elmqvist, N./Diakopoulos, N. (2017): Designing the User Interface: Strategies for Effective Human-Computer Interaction. 6. Auflage, Pearson, Harlow. ▪ Stanton, N./Salmon, P.M./Rafferty, L.A./Walker, F.H./Baber, Ch./Jenkins, D.P.. (2017): Human ▪ Factors Methods: A Practical Guide for Engineering and Design. 2. Auflage, CRC Press Taylor & Francis Group, Boca Raton

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®
- ☑ Course Book
- ☐ Vodcast
- ☑ Shortcast
- ☐ Audio
- ☑ Exam Template
- ☐ Review Book
- ☐ Creative Lab
- ☐ Guideline
- ☑ Live Tutorium/Course Feed

Studium Generale

Module Code: DLBSG_E

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

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

Module Coordinator
N.N. (Studium Generale I) / N.N. (Studium Generale II)

Contributing Courses to Module
▪ Studium Generale I (DLBSG01_E) ▪ Studium Generale II (DLBSG02_E)

Module Exam Type	
Module Exam	**Split Exam** Studium Generale I Studium Generale II
Weight of Module see curriculum	

Module Contents	
Studium Generale I In principle, all IU bachelor courses can be selected as courses for the "Studium Generale", so that the content can be chosen from the entire breadth of the IU distance learning program. **Studium Generale II** In principle, all IU bachelor courses can be selected as courses for the "Studium Generale", so that the content can be chosen from the entire breadth of the IU distance learning program.	
Learning Outcomes **Studium Generale I** On successful completion, students will be able to ▪ apply acquired key competencies to issues in their field of study and/or in their professional environment. ▪ to deepen one's own skills and abilities in a self-directed manner. ▪ to look beyond the boundaries of their own area of expertise. **Studium Generale II** On successful completion, students will be able to ▪ apply acquired key competencies to issues in their field of study and/or in their professional environment. ▪ to deepen one's own skills and abilities in a self-directed manner. ▪ to look beyond the boundaries of their own area of expertise.	
Links to other Modules within the Study Program It is a stand-alone offering with possible references to various required and elective modules	**Links to other Study Programs of IU International University of Applied Sciences** All IU Distance Learning Bachelor Programs

Studium Generale I

Course Code: DLBSG01_E

Study Level	Language of Instruction		CP	Admission Requirements
BA	English		5	None

Course Description

In the course "Studium Generale I", students deepen their knowledge in a self-selected subject area by completing an IU course outside their applicable curriculum. This gives them the opportunity to look beyond their own subject area and acquire further competencies. The associated option enables students to self-determine their study content to focus even more on issues relevant to them and/or to strengthen or develop selected competencies.

Course Outcomes

On successful completion, students will be able to

- apply acquired key competencies to issues in their field of study and/or in their professional environment.
- to deepen one's own skills and abilities in a self-directed manner.
- to look beyond the boundaries of their own area of expertise.

Contents

- The course "Studium Generale I" offers students the opportunity to take courses outside of their curriculum and the result can be credited as an elective subject. In principle, all IU bachelor courses that fulfill the following requirements can be chosen for this purpose:
  - They are not part of an integral part of the applicable mandatory curriculum.
  - They do not have admission requirements or students can prove that they have met the admission requirement.
- The examination of the selected courses must be taken in full and finally passed in order to be credited as part of the 'Studium Generale' .

Literature

Compulsory Reading

Further Reading

- See course description of the selected course

Studium Generale II

Course Code: DLBSG02_E

Study Level	Language of Instruction		CP	Admission Requirements
BA	English			None

Course Description
In the course "Studium Generale II", students deepen their knowledge in a self-selected subject area by completing an IU course outside their applicable curriculum. This gives them the opportunity to look beyond their own subject area and acquire further competencies. The associated option enables students to self-determine their study content to focus even more on issues relevant to them and/or to strengthen or develop selected competencies.

Course Outcomes

On successful completion, students will be able to

- apply acquired key competencies to issues in their field of study and/or in their professional environment.
- to deepen one's own skills and abilities in a self-directed manner.
- to look beyond the boundaries of their own area of expertise.

Contents

- The course "Studium Generale II" offers students the opportunity to take courses outside of their curriculum and the result can be credited as an elective subject. In principle, all IU bachelor courses that fulfill the following requirements can be chosen for this purpose:
  - They are not part of an integral part of the applicable mandatory curriculum.
  - They do not have admission requirements or students can prove that they have met the admission requirement.
- The examination of the selected courses must be taken in full and finally passed in order to be credited as part of the 'Studium Generale' .

Literature

Compulsory Reading

Further Reading

- See course description of the selected course

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 "myStudies": Written Assessment: Bachelor Thesis • Study Format "Distance Learning": Written Assessment: Bachelor Thesis Colloquium • Study Format "myStudies": Presentation: 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 IU International University of Applied Sciences
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 ▪ Turabian, K. L. (2013). A Manual for Writers of Research Papers, theses, and dissertations (8th ed.). University of Chicago Press. ▪ Lipson, C. (2018). How to write a BA thesis. A practical guide from your first ideas to your finished paper (2nd ed.). University of Chicago Press. ▪ Selection of literature according to topic

Study Format myStudies

Study Format	Course Type
myStudies	Thesis

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
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

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
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

- Subject specific literature chosen by the student

Study Format myStudies

Study Format	Course Type
myStudies	Thesis Defense

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed

Study Format Distance Learning

Study Format	Course Type
Distance Learning	Thesis Defense

Information about the examination	
Examination Admission Requirements	**BOLK:** no **Course Evaluation:** no
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® ☐ Course Book ☐ Vodcast ☐ Shortcast ☐ Audio ☐ Exam Template	☐ Review Book ☐ Creative Lab ☐ Guideline ☐ Live Tutorium/Course Feed