University of Applied Sciences

HOCHSCHULE EMDEN·LEER

Module Handbook
Master's Study Program
Business Intelligence and Data Analytics
(M.Eng.)

University of Applied Sciences Emden/Leer
Faculty Technology
Department Mechanical Engineering

Master Degree Program

(Version: 2024)

Table of Content

Overview

Faculty	Technology
Division	Mechanical Engineering
Degree	Master of Engineering (M.Eng.)
Standard period of study	3 Semester
Total Workload	90 ECTS

1. Introduction

Business Intelligence and Data Analytics is an advanced Master's program, which is primarily aimed at Bachelor's graduates from the fields of engineering or natural sciences. Prospective students must have at least one year of full-time work experience as a prerequisite for admission. The goal of the Master's program is for graduates to acquire professional and interdisciplinary qualifications.

Students learn statistical and computational methods for the acquisition, management and analysis of large and complex data sets as well as the extraction of knowledge and information from these data sets. The program also includes courses on data security, data confidentiality and data ethics. Taking into account the requirements and changes in the professional world, the program is designed to provide students with the necessary specialized scientific knowledge and methods in such a way that it enables them to reflect scientifically, apply scientific knowledge and methods and act responsibly in the relevant professional fields.

Graduates of the Master's program have excellent career opportunities in industry and business as well as in science and research.

With regard to the required knowledge of the students, the Business Intelligence and Data Analytics Master program pursues several goals. The students are able to achieve additional qualifications in the following areas:

- Technical skills
- Professionalization; expansion of social and personal competencies
- Business skills; as well as an introduction to the basics of business administration, law and various aspects of management

The introductory modules in the Business Administration/Management column (Business Modules) are conducted at Master's level. Students in the program have at least one year of work experience after completing their Bachelor's degree. In addition to social and professional skills, the students' personal skills are also important, which give the profile of the Business Intelligence and Data Analytics program the master's level.

In lectures and seminars, students are able to apply and reflect on the acquired skills and knowledge directly to practical professional situations, problems and questions. Students gain practical experience in teams (project work) as well as independently and learn to work on tasks in the areas of management, law and business administration and to solve problems under qualified guidance. The students' previous knowledge of the professional environment and the additional insights they gain into economic, administrative, legal and social contexts of the professional field can be integrated into the course of studies and promote personal and professional development.

The international profile of the students is closely related to the modules of the master's program Business Intelligence and Data Analytics. The students' previous knowledge enables them to grasp the contents of the master's program and thus to follow the learning objectives.

Module structure Business Intelligence and Data Analytics

Modules Master Business Intelligence and Data Analytics			
Master Thesis and Colloquium	28 ECTS	30 ECTS	3./5 Semester
Introduction to Scientific Working	2 ECTS		

Technical Mandatory Modules			**Professionalization Mandatory Modules**	**Business Mandatory Modules**			
Computer Sciences* 5 ECTS	Machine Learning* 5 ECTS	Project T* 5 ECTS	Communication & Culture* 5 ECTS	Controlling* 5 ECTS		25 / 20 ECTS	2./ 1. Semester 4. / 3. Semester
Data Management* 5 ECTS			Introduction to Data Science* 5 ECTS	Business Analytics* 5 ECTS	Project B* 5 ECTS	25 / 20 ECTS	1. / 2. Semester 3./4. Semester

Technical Compulsory Elective Modules		**Professionalization Compulsory Elective Modules**		**Business Compulsory Elective Modules**			
Simulation of Production Systems** 5 ECTS	Current Topic T** 5 ECTS	Quality Management** 5 ECTS	ERP-Systems** 5 ECTS	Current Topic B** 5 ECTS		15 ECTS	2./ 1. Semester 4. / 3. Semester
Digitalization and Automation** 5 ECTS	Current Topic T** 5 ECTS	Advanced Project Management** 5 ECTS		Marketing** 5 ECTS	Current Topic B** 5 ECTS	15 ECTS	1. / 2. Semester 3./4. Semester
Data Security ** 5 ECTS							

*Legend: * Mandatory Module total 45 CP (ECTS) **Compulsory Elective Module total 15 CP (ECTS); Optional selection of occupancy of modules*

Technical Modules	**Professionalization Modules**	**Business Modules**
• Computer Sciences • Machine Learning • Data Management • Project T • Current Topic T • Digitalization and Automation • Simulation of Production Systems • Data Security	• Introduction to Data Science • Communication & Culture • Advanced Project Management • Quality Management • Sustainable Innovation Management • ERP- Systems	• Business Analytics • Controlling • Project B • Current Topic B • Marketing

General Definitions

Every module of Business Intelligence and Data Analytics follows the principles below:

- English is the obligatory language of all modules and courses.
- One module has a time span of one semester and a successfully completed semester is rewarded with 30 ECTS.
- Every successfully completed module rewards students with 5 ECTS.
- The program has a modular structure, comprising mandatory and elective modules. These modules enable an interdisciplinary study in the fields of key qualifications, economics and technology.
- Generally, the order of modules is arbitrary and some of the elective courses are upon necessity. For particular courses the requirements of the module handbook are applicable. Thus, students are able to attend the offered courses each semester.
- By taking elective modules, individual specialization and deepening is possible. The scope of the mandatory modules is 45 credit points (ECTS). The modules from the compulsory elective area amount to 15 credit points (ECTS). In addition, there is the Master's thesis with colloquium amounting to 28 credit points (ECTS) in addition with the compulsory lecture Introduction to Scientific Working with 2 credit points (ECTS) amounting to a total of 30 credit points (ECTS). One credit point corresponds to 30 hours of work for the student.
- Courses not being part of the general curriculum of the study program Business Intelligence and Data Analytics are available upon request. A participation above 60% leads to a selection of the course as an elective module.
- The modules from the first and second semesters do not build on each other in terms of content, so that it is possible to start studying in the summer or winter semester. In the summer semester the modules of the first semester are offered, in the winter semester the modules of the second semester. Students who begin their studies in the summer semester first hear the courses from the first semester. In the following semester, they hear the courses from the second semester. For students who begin their studies in the winter semester, the order is reversed.

Abbreviations

Abbreviations and forms of examination

(DV) Creation and documentation of computer programs

(K) (#) written exam (processing time in time hours)

(M) oral examination

(P) project report

(R) presentation

(H) term paper

(S) student research project

(PA) Examinations of other kind

(SWS) Semester hours per week

According to the General Part of the Master Examination Regulations (Part A)

2. Mandatory Modules

2.1 Introduction to Data Sciences (Summer semester)

Lecturer in charge:	Prof. Dr. Elmar Wings
Form:	Lectures, exercises, case studies
Type:	Mandatory module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	term paper (H)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

Data Science is an interdisciplinary subject that brings together the fields of computer science, mathematics and the respective application area. After this course, students understand how all three areas are equally considered. Students know the essential components of data analysis, also of Big Data analysis, and their tasks. They are familiar with the basic functions of the components. Students know the general structure of the components and can illustrate and apply the basic algorithms and methods. They are not only familiar with libraries, frameworks, modules and toolkits, but can also use and implement them in a concrete way. Thus, they develop a deeper understanding of the interrelationships and learn how essential tools and algorithms of data analysis work in the core.

Content

The basics of Linear Algebra, Statistics and Probability Theory are developed and applied in Data Science. The properties of data sets are introduced so that the students also have a deeper understanding of Big Data. The students are not only able to consider ethical issues in collection and use, but also know the basics of the Basic Data Protection Regulation DSGVO). Furthermore, various algorithms from the field of Data Science are introduced with their areas of application. Models, e.g. k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering are shown. Different methods of supervised, unsupervised and reinforcement learning will be discussed. The course includes an introduction to Python 3 and its ecosystem.

Literature

- Howard Anton, Chris Rorres, Anton Kaul: Elementary Linear Algebra, Applications Version, Wiley, 2019
- Chesterton, Scott: Machine Learning: This Book Includes Machine Learning for Beginners, Artificial Intelligence and Machine Learning for Business, Networking for Beginners, Independently Published, 2019
- Grus, Joel: Data Science from Scratch: First Principles with Python, 2016, O'Reilly
- Datenschutz-Grundverordnung (DSGVO)
- Härdle, Wolfgang Karl, Lu, Henry Horng-Shing, Shen, Xiaotong: Handbook of Big Data Analytics, Springer, 2018

Course

Lecturer	Title	SWS
Prof. Dr. Elmar Wings	Introduction to Data Sciences	4

2.2 Communication & Culture (Summer semester)

Lecturer in charge:	Prof. Maria Krüger-Basener
Form:	Lecture and Seminar in combination
Type:	Mandatory module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	oral exam (Case Studies (M 30 min))
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

Students know theories on cultures and intercultural communication and understand the historical genesis of communication differences. The students perceive cultural differences in communication for concrete situations and can reflect, adapt and optimize their own personal behaviour.

Students are capable to cope with cultural diversity in given communication settings with focus on business related situations. The students can draw on sufficient experience and knowledge due to their cultural background, work experience and previously completed bachelor's degree, thus the course is taught at master's level.

Content

- Cultural Information: Germany in Comparison to selected students‘ countries of origin: Values and norms in business and in everyday life
- Basics of interpersonal communication
- Development of international communication in the course of time
- Models and theories on international communication, also within international enterprises
- Communication in international teams
- International communication systems and virtual team work

Literature

- Glover, Jerry; Friedman, Harris L. (2015): Transcultural competence. Navigating cultural differences in the global community. First Edition
- Hall, Edward T.; Hall, Mildred Reed (1990): Understanding cultural differences. Yarmouth, Me.: Intercultural Press.
- Hofstede, Geert H.; Hofstede, Gert Jan; Minkov, Michael (2010): Cultures and organizations. Software of the mind: intercultural cooperation and its importance for survival. 3rd ed. New York: McGraw-Hill.
- Jandt, Fred Edmund (2013): An introduction to intercultural communication. Identities in a global community. 7th ed. Thousand Oaks, Calif.: Sage Publications.
- Moran, Robert T.; Abramson, Neil R.; Moran, Sarah V. (2014): Managing cultural differences. 9. ed. London, New York: Routledge.
- Samovar, Larry A.; Porter, Richard E.; McDaniel, Edwin R. (Hg.) (2014): Intercultural communication. A reader. 14th edition. Wadsworth.
- St. Amant, Kirk; Kelsey, Sigrid (2012): Computer-mediated communication across cultures. International interactions in online environments. Hershey, PA: Information Science Reference.

Course

Lecturer	Title	SWS
Prof. Maria Krüger-Basener	Communication and Culture	4

2.3 Computer Sciences (Winter semester)

Lecturer in charge:	Prof. Dr. Rüdiger Götting
Form:	Seminar form lecture, exercises
Type:	Mandatory module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	preparation and documentation of a Computer Program (DV)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

By completing this course, students are able to implement complex project using standard libraries.
Moreover, the students understand standard paradigms in creating GUIs and implementing multi-thread applications. They comprehend object oriented paradigms and make use of standard methods in object oriented software-systems. The students are able to develop an application using an ide.

Content

The course contents might be summarized by four topics:

- Advanced concepts of a higher language
- Frameworks
- design patterns
- software development using an ide

Literature

- J. T. Streib, T. Soma: Guide to Java; Springer Verlag, 2014
- Lars Vogel: Eclipse IDE: Eclipse IDE based on Eclipse 4.2 and 4.3. vogella series.; 2013
- Lecture notes

Course

Lecturer	Title	SWS
Prof. Dr. Rüdiger Götting	Computer Sciences	4

2.4 Machine Learning (Winter semester)

Lecturer in charge:	Prof. Dr. Elmar Wings
Form:	Lectures and exercises
Type:	Mandatory module
Contact-Time (h):	45-60
Self-Study-Time (h):	90 - 105
Exam:	term paper (H)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

Machine learning refers to methods and tools that enable computers to make decisions without being explicitly programmed. In the last decade, the field of machine learning has made great progress, especially in areas such as natural language processing and computer vision. This course covers basic (e.g. linear models, tree-based models) and advanced (e.g. deep neural networks) methods of supervised machine learning and their application in various business contexts.

Students know and understand important basic principles and methods of symbolic Artificial Intelligence, especially knowledge representation, planning and inference. They are able to analyze procedures, approaches, ethical and technical risks, and limitations of intelligent systems and are able to develop and evaluate solutions for typical AI problems. Students are able to develop applications for Classifications and prognosis models using machine learning methods and to use them within their area of competence.

They can work on smaller problems both independently and in teams. They present their work in lectures and have to justify their choice of methods.

Content

In this module the following topics are covered:

- basic concepts: knowledge discovery in databases process, machine learning, exploratory data analysis, preparation of data sets, validation models, generalization
- linear and generalized regression models, logistic regression
- classic machine learning models: Bayesklassifikatoren, next-neighbour methods, decision trees, random forest trees, support vector machines
- model evaluation and selection
- neural networks, deep learning, convolutional neural networks for image processing tasks
- long short term memory for automatic language recognition and translation

Literature

- Katharina Zweig: Ein Algorithmus hat kein Taktgefühl, Heyne, 2019
- Hannah Fry: Hello World, dtv, 2019
- Josh Patterson, Adam Gibson: Deep Learning: A Practitioner's Approach. O'Reilly, 2017
- Jörg Frochte: Maschinelles Lernen Grundlagen und Algorithmen in Python. Hanser Verlag, 2019
- Joshi, Ameet V, Machine Learning and Artificial Intelligence. Springer (2020)
- Datenschutz-Grundverordnung (DSGVO)

Course

Lecturer	Title	SWS
Prof. Dr. Elmar Wings	Machine Learning	4

2.5 Data Management (Summer semester)

Lecturer in charge:	Dr. Tirazheh Zare Garizy
Form:	Lectures, exercises, case studies
Type:	Mandatory module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	report (H)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

To become a data driven company, it is essential to understand data management and develop an ecosystem, which meets data management requirements. The course will enable students to understand the principles of data management, and its use cases. It covers not only the technical and architectural aspects of the data collection and processing, but also the strategic aspects. Students can use the tools, methods, and guidelines to develop a holistic data management solution. They will also be able to deep dive in specific themes of data management and elaborate them in the relevant application area. Moreover, with case studies and exercises during the course, students will be able to gain hands-on experience during the course.

Content

The lecture includes the principles of data warehousing, fundamentals of data storage in data lake the cloud, and its associated ecosystem. It will furthermore focus on the topics like data strategy, data architecture, metadata management, data quality, and data governance.

Literature

- Strengholt, Piethein: Data Management at Scale: Best Practices for Enterprise Architecture, 2020, O'Reilly
- Linstedt, Daniel: Building a Scalable Data Warehouse with Data Vault 2.0, 2015, Morgan Kaufmann
- DAMA-DMBOK: Data Management Body of Knowledge: 2nd Edition, 2017, DAMA International

Course

Lecturer	**Title**	**SWS**
Dr. Tirazheh Zare Garizy	Data Management	4

2.6 Controlling (Winter semester)

Lecturer in charge:	Prof. Dr. Carsten Wilken
Form:	Seminar form lecture, exercises
Type:	Mandatory module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	written exam (K2)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

After having visited this lecture, students will be able to fulfill the main accounting-related tasks of Engineers in technical organizations, such as planning and control. Among others, they will be able to:

- Plan capital investments and evaluate investments proposals
- Submit yearly budgets for your area of responsibility and interpret reports about it
- In case of plan-to-actual deviations, analyze any reasons for this deviation
- Cost products and interpret product-costings.

In addition to this, the students will know how different costing-systems will affect key ratios of work and how that influences decision control. Thus, they will be able to use systems and values of internal accounting for decision making and decision control, and they will be able to evaluate existing procedures of companies.

Content

- Fundamentals of Accounting
- Accounting for decision making and control
- key figures of the accounting system
- Values and reports of Accounting
- Planning of Capital Investments
- Budgeting
- Product Costing
- Cost Allocation
- Systems of Cost Accounting (Absorption Costing, Variable Costing, Standard Costing)
- Variance Analysis

Literature

- Horngren, C.; Datar, S.; Foster, G.; Rajan, M.; Ittner, C.: /Foster: Cost Accounting – A Managerial Approach
- Zimmerman, J.: Accounting for Decision Making and Control; McGraw Hill

Course

Lecturer	Title	SWS
Prof. Dr. Carsten Wilken	Controlling	4

2.7 Business Analytics (Summer semester)

Lecturer in charge:	Prof. Dr. Elmar Wings
Form:	Seminaristic lessons, Serious gaming, Teamwork
Type:	Mandatory module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	presentation (R)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

Students gain the understanding and competence of how available internal and external company data can be analyzed in such a way that concrete entrepreneurial problems can be considered in an evidence-based manner and then solved. Business analytics is considered applied data science in business administration. Process-related questions, organizational internal interrelationships, etc. can be analyzed with the help of this discipline. The students learn four central phases "framing", "allocating", "analytics" and "preparation" and the respective methods to be able to process the phases. In their own case study, the students apply the theoretical knowledge and are guided to train intensively how they can also deal with ethical challenges of the discipline in the corporate context.

Content

- 4 BA phases (according to Seiter) "Framing", "Allocating", "Analytics", "Preparation", incl. associated methods
- Project and team management (e.g. agility, communication)
- Visualization of results
- Storytelling of results
- Linking data analytics with the mission, vision, strategy and goals of companies
- Dealing with Big Data (VVVV)
- The increased use of analytical models for the automated control of entire operational processes
- Transferring decisions from people to systems: (1) Purely digital processes, (2) Semi physically digitized processes, (3) Fully digitally controlled physical processes.
- Challenge by aspects of Disruption / within the Professional Field of Data Scienticst
- Critical discussion and reflection - opportunities, limits, data and privacy protection (DSGVO & differences to selected national jurisdictions)

Literature

- Seiter, Mischa: Business Analytics. Wie Sie Daten für die Steuerung von Unternehmen nutzen (2019)
- Weber, Felix: Künstliche Intelligenz für Business Analytics. Algorithmen, Plattformen und Anwendungsszenarien (2020)
- Martini, Mario: Blackbox Algorithmus – Grundfragen einer Regulierung Künstlicher Intelligenz (2019)
- Oppl, Stefan; Stary, Christian: Designing Digital WorkConcepts and Methods for Human-centeredDigitization (2019)

Course

Lecturer	Title	SWS
Prof. Dr. Elmar Wings	Business Analytics	4

2.8 Project T / Project B (Winter and Summer semester, alternating)

Lecturer in charge:	Degree program's coordinator
Form:	Solving of a problem independently under the guidance of a supervisor, presentation and discussion of the results preparation of a project report
Type:	Mandatory module
Contact-Time (h):	30
Self-Study-Time (h):	120
Exam:	project report (P)
ECTS:	5

Competences

Students are able to independently solve a comprehensive problem in the field of technology or economy in a scientifically sound manner using the knowledge and techniques acquired.

Content

The topic/problem can be proposed by the examinee but has to be approved by the examiner/supervisor.

Literature

- Question from the field of technology or economy
- Literature
- Project dependent literature

Course

Lecturer	Title	SWS
University lecturer of the study course	Project T / Project B	4

2.9 Master Thesis and Colloquium

Lecturer in charge:	Prof. Dr. Elmar Wings
Form:	To a large extent independent development of a problem and supervision.
Type:	Mandatory module
Contact-Time (h):	90
Self-Study-Time (h):	810
Exam:	**s**cientific report, Master thesis and Colloquium (S)
ECTS:	30

Competences

The students are able to work on a given problem. They are able to explore the current scientific literature independently and draw conclusions.
In doing so, they apply their acquired knowledge and develop goal-oriented solutions within the framework of their Master's thesis. They have in-depth knowledge in the field of project management and can apply this knowledge adequately in scientific projects.

Content

Current topics within the field of Business Intelligence and Data Analytics including

- technical deepening or one of the deepening within the department of technical engineering
- Independent acquisition of a subject with the help of technical literature and other sources
- Layout of verbal presentations and written scientific papers with the potential for scientific publication.

Literature

- Guide to Writing a Seminar Paper; Gök, Robert
- Special literature concerning the topic

Course

Lecturer	**Title**	**SWS**
Prof. Dr. Kathrin Ottink	Introduction to Scientific Working	2
Lecturer of the study course	Master Thesis and Colloquium	

3. Elective Modules

3.1 Marketing (Summer semester)

Lecturer in charge:	n.n.
Form:	Lecture, exercise class
Type:	Mandatory elective module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	case Study and written exam (K1)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

The students have a critical understanding of the most important theories, principles and methods of modern marketing and are able to identify, assess and solve issues with relevance to Marketing in unknown and complex contexts. To this end, they know how to use basic marketing tools such as the Ansoff matrix or the BCG product portfolio model. The underlying knowledge reflects the state-of-the-art in literature and research, and delves into selected fields of expertise. The students are able to critically discuss Marketing issues and to expand their knowledge base independently.

Content

The course is designed to be taught jointly in the Technical Management and Business Intelligence and Data Analytics programs, whose students usually have a technical and scientific bachelor's degree. For this reason, in addition to the teaching of general concepts, there is a consistent focus on business customer and industrial goods markets. The course will be held in English.

At the beginning, the role of marketing within a company is clarified as well as the importance of focusing all company activities on customers. Subsequently, purchasing behavior in the B2B (Business-to-Business) sector is explicitly considered. Principles and methods of market research are also discussed, with particular reference to modern methods of data collection and analysis. The basics of strategic marketing planning are conveyed as the guiding principles of the company's activities. This leads to a detailed examination of the elements of the marketing mix", i. e. the product, price, distribution and communication policy, each with selected special features for dealing with industrial markets. Product policy is based on the concept of the product life cycle and also deals with innovation and product modification processes as well as the management of brands and product ranges. Pricing policy focuses on cost-, demand-, and competition-oriented pricing methods as well as price management over time. In communication policy, the entire set of classical and modern communication instruments is considered, while in distribution policy all alternatives of direct and indirect distribution channels are dealt with. The concept of the customer journey integrates both.

All contents are being illustrated by using up-to-date examples from both consumer and industrial goods markets. Exercises and short case studies allow for an application of learned contents to real life scenarios. At the end of the semester, a use-case supported introduction to a CRM system takes place in order to let the students experience structures and possibilities of such standard software in the company.

Literature

- Jobber, David: Principles and Practice of Marketing. McGrawHill, latest edition.

Course

Lecturer	Title	SWS
n.n.	Marketing	4

3.2 Digitalization and Automation (According to demand, Summer semester)

Lecturer in charge:	Prof. Dr.-Eng. Armando W. Colombo
Form:	Lecture
Type:	Mandatory elective module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	**o**ral Exam (M)
ECTS:	5
Prerequisite for participation:	**-**
Applicability of the module:	MTM

Competences

Students will gain knowledge in the areas of applications in various manufacturing concepts, in the engineering of flexible and reconfigurable production and automation systems. Additionally, they will become acquainted with innovative digitalization and networking approaches and engineering methods for industrial eco-systems based on the Reference Architecture Model for Industry 4.0 (RAMI 4.0 – DIN SPEC 91345).
The course brings together diverse disciplines in a comprehensive manner, enabling students to develop a meaningful understanding of the complex associations and influences within a topic, thus project-based learning is an essential element.

Content

This session follows an integrated study approach; therefore, the students use and extend their knowledge in the areas:

- production-systems
- automation-systems
- information-systems in the production. The CIM Approach and related Technologies
- Digitalization and Networking of Industrial Productions-Ecosystems according to the Industry 4.0 Specifications

Literature

- A W Colombo et.al.: Industrial Cloud-Based Cyber-Physical Systems. The IMC-AESOP Approach. Springer Verlag 2014. https://link.springer.com/book/10.1007/978-3-319-05624-1
- A W Colombo et.al.: Digitalized and Harmonized Industrial Production Systems: The PERFoRM Approach. Taylor and Francis / CRC-Press 2019. https://doi.org/10.1201/9780429263316
- DIN SPEC 91345 (RAMI 4.0). Beuth Verlag 2017.

Course

Lecturer	**Title**	**SWS**
Prof. Dr.-Eng. A. W. Colombo	Digitalization and Automation	4

3.3 Simulation of Production Systems (According to demand, Summer semester, winter semester)

Lecturer in charge:	Prof. Dr.-Ing. Agnes Pechmann
Form:	Seminar, lecture, exercise
Type:	Mandatory elective module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	project report (P)
ECTS:	5
Prerequisite for participation:	ERP-Systems
Applicability of the module:	MTM

Competences

Students are able to capture data, energy and material flows in production systems or extract them from ERP-System, represent them in models and simulate them dynamically. Anylogic software is used for the simulation. Using concrete examples (e.g. Production CompanyLearning Factory Fischertechnik, Automated Classroom), students also learn to represent a (production) system with its resources, products and data and to label it according to current standards, e.g. RAMI 4.0.

Content

Identification of essential resources and flows (energy, material, data), creation of suitable models and their dynamic simulation (time-discrete / agent-based), data availability and provision for the simulation, introduction to the simulation software, simulation of an example environment.

Literature

- Bungartz, Hans-Joacheim et al.: Modellbildung und Simulation, eine anwendungsorientierte Einführung, Springer 2009, DIN SPEC 91345:2016-04
- Grigoryev, Ilya: AnyLogic 7 in Three Days: A quick Course in Simulation Modelling, 2014
- Kosturiak, Jan; Gregor, Milan: Simulation von Produktionssystemen, 1995 (Bibliothek Emden, Handapparat)

Course

Lecturer	Title	SWS
Prof. Dr.-Ing. Agnes Pechmann	Simulation of Production Systems	4

3.4 Data Security (According to demand in Winter-, Summer semester)

Lecturer in charge:	n.n.
Form:	Lectures and exercises
Type:	Mandatory elective module
Contact-Time (h):	45-60
Self-Study-Time (h):	90-105
Exam:	coursework (H)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

The lecture provides an orientation to the topic of security of information technology systems. The students learn which interests in security should be protected and which technical and organizational requirements result from the security interests. It is mediated, which content wise security requirements can be supported by which technical security measures. In addition, students learn how IT systems can be designed, implemented and operated from a security perspective. The students gain an understanding of the above-mentioned aspects and possible approaches to solutions.

Content

In this module the following topics are covered:

1. basics of IT systems, especially networks and operating systems
2. security interests and protection goals
3. Authentification
4. Access control
5. cloud security, cooperation with cloud providers, security aspects of data mining and big data
6. IT Security Management

Literatur

- M. Bishop, Computer Security: Art and Science, Addison-Wesley, Boston, 2018
- C. Eckert, IT-Sicherheit: Konzepte - Verfahren - Protokolle. Oldenbourg 2018
- J. Biskup, Security in Computing Systems: Challenges, Approaches and Solutions. Springer, Berlin, 2008.

Dozent	**Titel der Lehrveranstaltung**	**SWS**
nn	Data Security	4

3.5 ERP- Systems (Summer semester)

Lecturer in charge:	Prof. Dr.-Ing. Agnes Pechmann
Form:	Lecture, exercises
Type:	Mandatory elective module
Contact Time (h):	60
Self-Study-Time (h):	90
Exam:	project report (P)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

After attending the module, students are able to understand, follow and apply the basic functions of ERP systems. Different concepts and approaches for the technical and conceptual architecture of these systems are identified and evaluated for their practical use. Students will be able to specify business requirements for typical companies and how they are met by different systems.

Content

The following topics are provided in this module: computer sciences

- ERP-Basics
- Architecture of ERP-Systems
- Typical business processes in ERP-Systems focusing on production
- Applying an ERP-System in a company realistic environment (Serious Game ERPsimon basis of SAP S/4HANA)

Literature

- SAP S/4HANA Learning Material
- Literature recommendations will be provided on Moodle at the beginning of the semester.
- Participant's guide ERPsim

Course

Lecturer	Title	SWS
Prof. Dr.-Ing. Agnes Pechmann	ERP-Systems	4

3.6 Quality Management *(Winter semester)*

Lecturer in charge:	Prof. Dr. Monika Blattmeier
Form:	seminar form lectures presentations and papers (acquired by the students according to given conditions)
Type:	Mandatory elective module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	report (R) and oral exam (M)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

Understanding the importance of Quality Management and estimating the potential of QM-oriented approaches. Understanding of QM philosophies and QM dominated thinking and becoming acquainted with QM methods and QM tools. Practice in team-oriented methods as well as deepening of comprehensive thinking. Furthermore, stabilization of structured, documented work approaches plus strengthening of customer-oriented work approach.

Content

- Introduction
- Development and History of QM
- QM philosophies
- ISO 9000 and extended Approaches
- QM Tools and Methods in R&D and Production
- Problem solving Tools
- Improvement Methods
- Management Tools

Literature

- Sommerhoff, B.: QM im Wandel: Personenzentriertes Innovations- und Qualitätsmanagement -München: Hanser, 2021
- Tarvin, P.: Leadership & Management of Machining - München: Hanser, 2016
- Gryna, F.M.: Juran's quality planning & analysis Boston (MA): McGraw-Hill, 2007
- Masing, W.: Handbuch des Qualitätsmanagements - 6. Auflage München: Hanser, 2014
- Linß, G.: Qualitätsmanagement für Ingenieure - München: Fachbuchverlag Leipzig in Hanser, 2011
- Pfeifer, T.: Quality management: strategies, methods, techniques - München: Hanser, 2002
- Hering, E.: Qualitätsmanagement für Ingenieure -5. Auflage- Berlin: Springer, 2003
- Juran, J.M.: Juran's Quality Handbook - 6th edition - New York (NY): McGraw-Hill, 2010
- DIN EN ISO 9000:2015 and related standards
- SA8000; SCC, OHSAS 18001
- actual developments and subjects: Internet

Course

Lecturer	Title	SWS
Prof. Dr. Monika Blattmeier	Quality Management	4

3.7 Sustainable Innovation Management *(Winter semester)*

Lecturer in charge:	Prof. Dr.-Eng. Armando W. Colombo
Form:	lecture
Type:	Mandatory elective module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	term paper and presentation (R)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MTM

Competences

Students will be able to explain the importance of innovation processes and work with international standards for innovation management. They are further able to understand or apply the typical innovation tools such as Technology Readiness Level (TRL), Hype Cycle and IP Management Systems.
Students are proficient in using creativity techniques and standardized methods and tools to generate, execute and manage innovation activities.
Students have gained experience in teamwork and presentation techniques during practical phases. The high proportion of self-learning is didactically underpinned by homework.

Content

An organization's ability to innovate is recognized as a key factor for sustained growth, economic viability, increased well-being and the development of society. In this sense, the innovation capabilities of an organization include the ability to understand and respond to changing conditions of its context, to pursue new opportunities and to leverage the knowledge and creativity of people within the organization in collaboration with external interested parties. This module is intended to transfer the background knowledge to students by establishing a coherent, consistent and common framework to: (a) understand the main terms, definitions, concepts and principles of innovation management; (b) learn how an innovation management system and other innovation management standards should be used, with focus on the ISO 56000, ISO 56002 and the Oslo Manual on Innovation; (c) facilitate communication and create awareness on how innovation activities should be planned and executed; (d) learn tools and methods to support innovation management (e.g. Hype Cycle, TRL and SRL definitions and applications, IP-Protection and Patenting Processes). In this context, the curriculum of the module provides the fundamental concepts and innovation management principles, describing why organizations should engage in innovation activities.
Innovation is one of the drivers of business success. The aim of this module is to provide practical knowledge about modern innovation techniques in the field of engineering.
This module provides knowledge about
- The phases in innovation projects
- Excellence, impact and implementation of innovation activities
- Innovation management: methods and tools
- Intellectual property management: patents and intellectual property protection

Literature

- Harvard Business Review: HBR's 10 Must Reads on Innovation; Harvard Business Review Press, 2013
- Dodgson, M. / Gann, D.: The Oxford Handbook of Innovation Management; Oxford University Press, 2014
- The Measurement of Scientific, Technological and Innovation Activities. The OSLO Manual 4th Edition. European Union, Print Catalogue number: KS-01-18-852-EN-C, ISBN 978-92-79-92581-8
- International Standard ISPO 56000, ISO 56002. Innovation Management (Fundamentals and Vocabulary). 2022.
- Günther Schuh, Christian Dölle: Sustainable Innovation - Nachhaltig Werte schaffen, Springer Verlag, 2021

Course

Lecturer	Title	SWS
Prof. Dr.-Eng. Armando W. Colombo	Sustainable Innovation Management	4

3.8 Advanced Project Management (According to demand, Winter semester)

Lecturer in charge:	Prof. Dr. Andreas Haja
Form:	lecture, group discussion, case studies
Type:	Mandatory elective module
Contact-Time (h):	60
Self-Study-Time (h):	90
Exam:	written exam (K2)
ECTS:	5
Prerequisite for participation:	-
Applicability of the module:	MMB, MTM

Competences

The students are able to plan and execute a technical project. They know the difference between classic and agile project management and are able to form a SCRUM team and independently allocate roles within it. The students are able to establish communication interfaces to other teams and to plan and execute a complex work process. Furthermore, they are able to present the project status and work results in a structured manner.

Content

Over the course of the semester, the students carry out an elaborate business game in the context of which an autonomous small robot is constructed in a team of approx. 6 students. The team is structured according to agile principles and the students learn how to apply the SCRUM method in practice. Furthermore, communication methods are practiced by requiring each team to cooperate with a partner team to solve a common task. In addition, skills for structuring projects, time and resource planning are taught. The lecture will conclude with a hands-on demonstration of the constructed small robots. During the lecture, the theoretical content will be taught, status reports of the teams will be discussed, and individual team coaching will be provided.

Keywords:

- Agile project management, SCRUM, time and resource planning, communicating project status, inter-team communication.

Literature

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition and Agile Practice Guide

Course

Lecturer	Title	SWS
Prof. Dr. Andreas Haja	Advanced Project Management	4

3.9 Current Topic T (Winter-, Summer semester)

Lecturer in charge:	n.n.
Form:	Solving of a problem independently under the guidance of a supervisor, presentation and discussion of the results
Type:	Mandatory elective module
Contact-Time (h):	30
Self-Study-Time (h):	120
Exam:	presentation (R)
ECTS:	5

Competences

Students are able to independently solve a comprehensive problem from the field of Business Intelligence and Data Analytics in a scientifically sound manner using the knowledge and techniques they have learned.
The students demonstrate that they are able to deal with the scientific literature on a specific issue in depth and can prepare it in a targeted and structured manner.
Students demonstrate that they have presentation and communication skills that enable them to present topics they have developed themselves in a clear and structured manner and to discuss their applicability to practice.

Content

Students work on a scientific-application-oriented problem in the area of technology. In lectures by the lecturers, the most important theories as well as current research results on a specific topic from the fields of technology or business are presented. By reading scientific literature (self-study), students deepen their knowledge of theories and methods in the field and learn how to use scientific literature. At the end of the course, students will be able to establish a relationship between the research question and scientific theories and research results.

Literature

Slides, case studies, scientific literature

Course

Lecturer	Title	SWS
University lecturer of the study course	Current Topic	4

3.10 Current Topic B (Winter-, Summer semester)

Lecturer in charge:	n.n.
Form:	Solving of a problem independently under the guidance of a supervisor, presentation and discussion of the results
Type:	Mandatory elective module
Contact-Time (h):	30
Self-Study-Time (h):	120
Exam:	examination of other type (PA)
ECTS:	5

Competences

Students are able to independently solve a comprehensive problem from the field of Business Intelligence and Data Analytics in a scientifically sound manner using the knowledge and techniques they have learned.
The students demonstrate that they are able to deal with the scientific literature on a specific issue in depth and can prepare it in a targeted and structured manner.
Students demonstrate that they have presentation and communication skills that enable them to present topics they have developed themselves in a clear and structured manner and to discuss their applicability to practice.

Content

Students work on a scientific-application-oriented problem in the area of business. In lectures by the lecturers, the most important theories as well as current research results on a specific topic from the fields of technology or business are presented. By reading scientific literature (self-study), students deepen their knowledge of theories and methods in the field and learn how to use scientific literature. At the end of the course, students will be able to establish a relationship between the research question and scientific theories and research results.

Literature

Slides, case studies, scientific literature

Course

Lecturer	Title	SWS
University lecturer of the study course	Current Topic	4