Course Compendium

for the Master's Degree Course

TECHNOLOGY AND INNOVATION MANAGEMENT

at the Faculty of Automation and Computer Science

▲ Hochschule Harz
Hochschule für angewandte Wissenschaften

state as of: April 7, 2021

Contents

Preamble

Course

Study Program:	Technology and Innovation Management
Degree:	Master of Engineering
Shorthand:	ITIM
Study Program Number:	702
Variants:	231 Fast Track, Summer Semester
	232 Fast Track, Winter Semester
	241 Regular Track, Summer Semester
	242 Regular Track, Winter Semester
Version:	2020

General information

Course frequency: All current courses at the Faculty of Automation and Computer Science are offered annually. Exceptions may be determined, depending on lecturer availability (in case of prolonged illness, sabbatical semester, etc.). One-time courses, e.g., as part of professional field orientations or elective subjects, will be explicitly announced as such.

Prerequisites for receiving credit points: Credit points (ECTS points) are awarded for a course as soon as all partial examinations of the course are passed. This includes study-accompanying tests such as proof of course attendance ('proof'). Taking an examination has no particular prerequisites, and is always possible for anybody who has taken the associated course.

Course duration: Each course duration can be calculated using the information listed under Assigned to Curricula in all course descriptions.

Examination types

All course examinations are marked with grades. These may be retaken no more than two times. Study-accompanying tests may only be taken if the associated course is being taken, too. These may be retaken as often as required. ECTS points are awarded only after all examinations and study-accompanying tests associated with the course have been passed.

Examination types according to the examination regulations	**Abbr.**
written examination (120, 90, 60 minutes)	K120, K90, K60
essay	HA
project thesis / practical work	PA
design study	EA
presentation (incl. seminar paper)	RF
oral examination	MP
report (incl. paper & presentation)	BE
Colloquium	KO
Bachelor's Thesis	BA
internship / practical training	PR
Master's Thesis	MA

Study-accompanying tests	**Abbr.**
proof (of course attendance)	T

In course descriptions, a / separates multiple possible examination types. At the start of the semester, the respective lecturers of each unit will announce which examination type(s) will be held for their units. In the case that a course consists of multiple units, usually a combined course examination will be held, containing percentally weighted portions of the unit contents. Examination types for multiple units may differ in this case. In case the course requires any additional, study-accompanying tests, these are listed following the examination types, separated by a comma.

Grades are usually assigned based on the percentual results of the examination as shown in the following table:

Percent	< 50%	≥50%	≥58%	≥63%	≥68%	≥72%
Grade	5	4.0	3.7	3.3	3.0	2.7

Percent	≥76%	≥80%	≥85%	≥90%	≥95%
Grade	2.3	2.0	1.7	1.3	1.0

Alphabetical List of Courses

Course Agile Requirements Engineering and Digital Transformation

Module Name	Agile Requirements Engineering and Digital Transformation
Module No.	2565
Unit/s	Agile Requirements Engineering and Digital Transformation (lecture) and Agile Requirements Engineering and Digital Transformation (lab)
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	4 SWH (2 SWH Lectures, 1 SWH Excercise, 1 SWH Lab)
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Thomas Leich
Lecturer	Prof. Dr. Thomas Leich
Objective of the Module	Students know the basics and methods of agile (software) development with the focus on requirements engineering as a part of the digital transformation process. In addition, they are able to use techniques and concepts of product line engineering and technical innovation management and integrate them into agile procedure.
Prerequisites	
Content	• Classical Requirements Engineering • Agiles Manifest and Principles • (Software-)Kanban • Feature Driven Development • Scrum • Agiles Requirements Engineering • Requirements in Teams • Agiles Portfolio Management and Planning • Continious Development and Improvement • Software Product Lines
Literature	• K. Pohl: Requirements Engineering. Fundamentals, Principles, and Techniques. Springer, 2010. Representation of intentions and dependencies • Ramsin, R., Paige, R.F., Process-centered review of object- oriented software development methodologies." ACM Computing Surveys, Vol. 40, No. 1 (February), Article 3, pp. 1–89, 2008. • Abrahamsson, P., Warsta, J., Siponen, M.T., Ronkainen, J., New directions on agile methods: A comparative analysis." In Proceedings of the International Conference on Software Engineering (ACM/ICSE 2003), pp 244–254, 2003. • Beck, K., et al., Manifesto for Agile Software Development. 2001, Available online at: http://agilemanifesto.org (Last visited: 20 September 2020). • Snowden, D.J., Boone, M.E., A Leader's Framework for Decision Making. Harvard Business Review, November 2007. • Rubin, K.S., Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2012. • Schwaber, K., Sutherland, J., The Scrum Guide, Published online at: http://www.scrumguides.org/, July 2013 . • Agile Alliance, Guide to Agile Practices, Published online at: http://guide.agilealliance.org/). Requirements Practices for Teams, Programs, and the Enterprise, Addison Wesley, 1. edition • Sven Apel, Don Batory, Christian Kästner, and Gunter Saake. Feature-Oriented Software Product Lines - Concepts and Implementation. Springer, October 2013
Media used	Script, projector, lab
Form of Examination	HA/MP and T
Language	English

Course Big Data and Geoinformation

Module Name	Big Data and Geoinformation
Module No.	2595
Unit/s	Big Data and Geoinformation
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	4 SWH Lectures
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Hardy Pundt
Lecturer	Prof. Dr. Hardy Pundt and Prof. Dr. Fabian Transchel
Objective of the Module	Candidates are well-versed in Data Analytics based on Big Data infrastructure and Big Data processing, especially in regards to Geoinformation. They know how to import, extract, manipulate, process and analyse spatial data as well as financial or industrial time series.
Prerequisites	Bachelor-level mathematics
Content	Big Data: • Definitions: What is Big Data, Data Science, Machine Learning and Artificial Intelligence? • Big Data • Map-Reduce • Spark, Hadoop, Kafka • Data Warehousing • Machine Learning • Supervised Learning • Unsupervised Learning • Pattern Recognition and Clustering • Dimensionality Reduction Techniques • Artificial Neural Nets • Data Analytics • The exponential function • Correlation vs. causation • Representation theory and scientific communication • Big Data Ethics • Data privacy, GDPR • The discrimination problem of ML • Ethics of autonomous decision making Geoinformation: • Ellipsoid models of the Earth • Spatial reference systems, scale • characteristics of spatial data: geometry, topology, attributes, time • raster and vector model • acquisition (digitalization from maps, GPS-supported field data collection, remote sensing) • storage and administration of spatial data (spatial databases) • introduction to GIS: QGIS and ArcGIS online • analysis methods, e. g. • distance- and area-based methods (sizes, centroids etc.) • overlay • buffering • Delauney triangulation • Thiessen polygons • spatial interpolation (e. g. IDW, Kriging) • visualisation • cartographic principles • 2D maps • 3D models (including 3D analysis methods) • interoperable GI services and Web Mapping • Web Mapping Services • Geography Markup Language • standards of the Open Geospatial Consortium (OGC) • exemplary open Web-Mapping tools • open, spatial data • guidelines and standards (from ISO, OGC, EU (e. g. INSPIRE)) • all themes are supported by exercises using QGIS, ArcGIS online and other tools
Literature	• Tibshirani, Hastie: Elements of Statistical Learning, Springer • Seehafer, Nörtemann: Acturial Data Science, De Gruyter • Longley, Goodchild, Maguire, Rhind: Geographic Information Systems and Science. Wiley & Sons. • Wegmann, Schwalb-Willmann: Introduction to Spatial Data Analysis. Pelagic Publishing

Media used	Script, projector, white board, exercises using various tools
Form of Examination	HA/RF/PA/MP
Language	English

Course Digital Business Models and Idea Engineering

Module Name	Digital Business Models and Idea Engineering
Module No.	2575
Unit/s	Idea Engineering and Digital Business Modelling
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	3 SWH Lecture, 0.5 SWH Exercise, 0.5 SWH Lab
Workload	56 h attendance, 69 h self study
Module Responsible	Prof. Dr. Hans-Jürgen Scheruhn
Lecturer	Lecturer Department Automation and Informatics
Objective of the Module	Digital Business Models Students learn how to depict Digital Business Model Canvas based on Osterwalder et all. This model aims to show at a glance how a company earns its money today and in the digital future. By analysing 9 different aspects of possible digitalisization like Key Ressources or Customer Relationship the students estimate the overall as-is digitalization grade of a company first and second identify aspects to improve (like Value contribution or Key activities). They learn how to depict all 9 aspects based on an integrated information model architecture like Enterprise GPS and understand how these are implemented using business software such as SAP S/4 HANA. Accordingly, they are able to monitor and control the movement of money, goods and information within a company. Students learn how to differentiate between various Layers and Levels of the Enterprise GPS model architecture and they are able to understand its horizontal and vertical navigation based on a BPM tool like ARIS correctly. Idea Engineering Students learn to use different Idea Engineering methods to generate new ideas. These methods will be used on a concreate case study to generate different ideas for new services of an organization. Six different groups present their own view on idea engineering methods or innovation processes and moderate a session with their class mates. The aim is to know when to use which process/method and how to use it in practise.
Prerequisites	none
Content	Idea Engineering: 1) Introduction into Lecture with a Case Study 2) Theory of Innovation and Innovation Management 3) Different Idea Engineering Methods in Detail 4) Innovation Processes 5) Design Thinking Process 6) Business Model Innovation
Literature	• Osterwalder et. al.: Business Model Generation; Scheruhn, H. et al.: Information Modelling and Process Modelling. In Von Rosing, M., Scheel,H., Scheer, A-W. The Complete Business Process Handbook. Body of Knowledge from Process Modelling to BPM Volume 1, Elsevier 2015, pp 511-550 : http://store.elsevier.com/The-Complete-Business-Process-Handbook/Mark-von-Rosing/isbn-9780127999593/) • Cooper, Robert G. (2008): Perspective: The Stage-Gate Idea-to-Launch Process – Update, What's New, and NexGen Systems. In: J Product Innovation Man 25 (3), S. 213–232. DOI: 10.1111/j.1540-5885.2008.00296.x. • Hasso Plattner Institute of Design at Standford (Hg.): An Introduction to Design Thinking. Facilitator's Guide: Script talking points, takeways, and setup considerations. Online verfügbar unter https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/58ac891ae4fcb50f1fb2f1ab/1487702304601/Facilitators+Guide_Design+Thinking.pdf, zuletzt geprüft am 12.06.2020 • Tran, N.: Design Thinking Playbook. For Change Management in K12 Schools. Online verfügbar unter https://dschool.stanford.edu/resources/design-thinking-playbook-from-design-tech-high-school, zuletzt geprüft am 12.06.2020. • Chesbrough, H.; Schwartz, K. (2007): Innovating business models with co-development partnerships. In: Research Technology Management 50 (1), S. 55–59.
Media used	Online case studies (ILIAS)
Form of Examination	K120/ HA / MP
Language	English

Course Engineering Project

Module Name	Engineering Project
Module No.	2555
Unit/s	
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	4 SWH Excercise
Workload	56 h attendance, 69 h self study
Module Responsible	Prof. Dr.-Ing. Günter Bühler
Lecturer	Prof. Dr.-Ing. Günter Bühler
Objective of the Module	The goal of the module is to get the ability to perform basic calculations for the design of a permanent magnet excited synchronous generator using the finite element method based on the ANSYS software. This includes FEM simulations in the fields of structural mechanics, thermal management and permanent or electrically excited magnetic fields. Finally, the simulation results are checked by measurement using a model generator. The students ... - know different simulation techniques in terms of modeling and simulation methodology - have basic knowledge of ANSYS programming - know the differences of steady-state / transient calculations - can handle nonlinear material behavior in the simulation - can perform a modal analysis for a mechanical system - can evaluate and interpret the results - know the basics for the calculation of stresses in mechanical components, especially in beams - can apply the heat transfer mechanisms 'heat conduction' and 'convection' to thermal tasks in the simulation - know the basic concepts in the field of magnetism and are able to calculate and simulate simple magnetic circuits analytically.
Prerequisites	Basic knowledge in technical mechanics and electrical engineering as well as magnetic fields
Content	Basics of the finite element method: (discretization, meshing, Ritz's method, approach functions, element types, sources of errors, basics of modelling, analytical verification, methods of analysis: static, transient, modal, linear, non-linear), degrees of freedom, application of loads and constraints, utilization of symmetries ANSYS: Programming language APDL, introduction to FEM simulation with ANSYS, application examples from the field of electrical machines Programming examples: Strength theory/structural dynamics 2D/3D, thermal (heat conduction, convection), electric heat generation, heat flux, magnetic circuit / magnetic simulation, inductance determination, forces resp. torque in electric machines
Literature	
Media used	Script, projector, movies
Form of Examination	EA/PA/BE
Language	English

Course Environment, Health & Safety

Module Name	Environment, Health and Safety
Module No.	2518
Unit/s	
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 1 SWH Excercise, 1 SWH Lab
Workload	56 h attendance, 69 h self study
Module Responsible	Prof. Dr. Andrea Heilmann
Lecturer	Juliane Leßmann
Objective of the Module	Students are able to understand the meaningfulness of environmental aspects in the society and their future jobs. They are given insights of enironmenally friendly ways to produce obejcts and to run businesses. They deeply understand the STOP method (substitution, technical, organizational and personell) to minimize any type of risks which may occur. They are trained to perform a work risk assessment and to find actions accordingly for risk minimization. They got a deeper backround knowledge on basic environmental technologies (e. g. waste management/ circular economy, water management, treatment of air pollution) and about environmental and occopational health and safety management systems.
Prerequisites	None
Content	• Introduction to EHS • Risk Assessment • Technologies for Occupational Health and Safety • Environmental technologies: Water supply and waste water management; Waste management/ circular aconomy; Treatment of air pollution • Integrated product policy • Environmental and Occopational Health Management Systems
Literature	• Script (English) and working sheets
Media used	Script, projector
Form of Examination	HA/RF/PA/K90/K60
Language	English

Course Functional Safety

Module Name	Functional Safety
Module No.	2585
Unit/s	Functional Safety (lecture) and Functional Safety (lab)
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	1 SWH Lecture, 1 SWH Excercise, 2 SWH Lab
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. René Simon
Lecturer	Prof. Dr. René Simon
Objective of the Module	Students know and understand the thinking behind technical safety, including functional safety and IT security. Students are familiar with the relevant international standards. Students are able to perform risk analysis and document them. Students are able to use their gained knowledge during the design, implementation and launch of safe control algorithms. Students are not able to design systems or perform safety verifications.
Prerequisites	Basic knowledge on informatics
Content	• Introduction • Safety term and basic approach to achieve safety • Device safety • Functional Safety (definition, examples, models, standardization, limits, risk analysis, system behaviour, communication media) • Connections to IT-security • Ways to achieve safety • Draft and implementation of safe control algorithms for devices
Literature	
Media used	Script, projector
Form of Examination	HA/MP and T
Language	English

Course German as a Foreign Language (Option 1)

Module Name	German as a Foreign Language
Module No.	1247
Unit/s	
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 2 SWH Excercise
Workload	56 h attendance, 69 h self study
Module Responsible	Jutta Sendzik
Lecturer	Lecturer Language Centre
Objective of the Module	The students will - attain levels A1 - B2 according to their prior knowlegde of German in all four language skills: speaking, listening, reading, writing. - obtain a vocabulary of about 500 basic German words at level A1, 1100 at level A2, 1800 at level B1, and 2600 at level B2. - become familiar with the most basic structures (syntax, declination, conjugation) of the German language as well as with German pronunciation
Prerequisites	none for A1, prior levels to A2-B2
Content	A1: greetings, asking questions (e.g. directions), shopping, food, public transport, housing, sharing personal information, health A2: study, life on campus, German educationla system, weather, complaining, people and their clothes, where people live, B1: partners and neighbours, diet and lifestyle, nature and environment, marketing texts, job satisfaction, the media, German history B2: describing people, living conditions, pursuing a career, digital media, environmental protection, reading fiction, speaking about learning strategies
Literature	A1 Akademie Deutsch A1.1 / A1.2, Hueber 2019, Nicos Weg (Onlinekurs der DW) A2 Akademie Deutsch A2, Hueber 2019, Nicos Weg B1.1 Panorama B1.1, Cornelsen 2017 B2.1 Weitblick B2.1, Cornelsen 2019
Media used	(e-)textbooks, Internet, presentation software
Form of Examination	HA/RF/MP/PA
Language	German / EMI

Course English as a Foreign Language (Option 2)

Module Name	English as a Foreign Language
Module No.	1248
Unit/s	English as a Foreign Language
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 2 SWH Exercise
Workload	56h attendance, 69h self study
Module Responsible	Jutta Sendzik
Lecturer	Jutta Sendzik
Objectives of the Module	The students will - develop their competence in subject-specific language (comprehension, active use of lexical items and phraseology, knowledge of the structures of text varieties) - acquire competence in presentation skills - consolidate abilities to participate in academic and workplace discussions - extend their understanding of core values of academic ethos
Prerequisites	B2 level of CEF
Content	- preparation, structuring, and delivery of presentations - learning linguistic means for leading discussions, describing processes, and writing different types of academic text - usage of purposeful language - strategies for dealing with and avoiding plagiarism
Literature	Olson, R.: Don't be such a scientist, 2nd ed., ISLAND PRESS, 2018 Leßmöllmann, A. et al.: Science Communication, de Gruyter, 2020 Neville, C.: The complete guide to referencing and avoiding plagiarism, 3rd. ed., Open University Press, 2016 Powell, M.: Dynamic presentations, Klett, 2011
Media used	(e-)textbooks, Internet, presentation software
Form of Examination	HA/RF/MP/PA
Language	English

Course Information Retrieval Technology

Module Name	Information Retrieval
Module No.	2572
Unit/s	Information Retrieval (lecture) and Information Retrieval (lab)
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 1 SWH Exercise, 1 SWH Lab
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Frieder Stolzenburg
Lecturer	Prof. Dr. Frieder Stolzenburg
Objective of the Module	Students know the basic terms and models of information retrieval, data mining, and knowledge discovery. They are able to understand methods of data mining and machine learning using special tools and to apply them e. g. in industry 4.0 management.
Prerequisites	recommended: math
Content	Information Retrieval • basic terms and foundations • knowledge discovery process • process models Methods • regression and correlation • decision trees • cluster analysis • association rules • neural networks
Literature	• Charu C. Aggarwal. Data Mining – The Textbook. Springer, Cham, Heidelberg, New York, Dordrecht, London, 2015. • Michael J. A. Berry, Gordon Linoff: Data Mining Techniques. For Marketing, Sales, and Customer Support. John Wiley & Sons, New York, Chicester, Weinheim, Brisbane, 2nd edition, 2004. • C. D. Manning, P. Raghavan, H. Schütze. An Introduction to Information Retrieval. Cambridge University Press, Cambridge, England. Online edition, 2009.
Media used	script, projector, examples, lab
Form of Examination	K120/EA/MP/ RF and T
Language	English

Course Introduction to Industry 4.0

Module Name	Introduction to Industry 4.0
Module No.	2552
Unit/s	Introduction to Industry 4.0 (lecture) and Introduction to Industry 4.0 (lab)
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 1 SWH Exercise, 1 SWH Lab
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. René Simon
Lecturer	Prof. Dr. René Simon
Objective of the Module	The students: - are in a position to gather and interpret typical features of Industry 4.0 systems - command basic knowledge about Industry 3.0 (e. g. control, communication, robotics) - know basic Industry 4.0 models and standards - may use their knowledge to design, implement and test appropriate laboratory systems - are able to use basic engineering tools
Prerequisites	none
Content	• History of Industry 4.0 • Reference Architecture Model Industry 4.0 (RAMI) • Data as requirement, resource and vital outcome of production • Sustainable data management and data identification • Advanced industrial control strategies (e. g. motion) • Usage of digital data to connect business layers and production units
Literature	
Media used	Script, projector
Form of Examination	EA/PA/BE and T
Language	English

Course Introduction to Research Fields in Computer Science

Module Name	Introduction to Research Fields in Computer Science
Module No.	2556
Unit/s	
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 2 SWH Exercise
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Thomas Leich
Lecturer	Prof. Dr. Thomas Leich
Objective of the Module	Computer Science (CS) has grown beyond its own bounds to become a multidisciplinary field that touches many other fields of science and overlaps with engineering disinclines. Over the years, CS has developed quickly in both depth and breadth and now consists of a range of sub-areas. The development of the next generation of cyber-physical systems requires engineers to have a broad knowledge of current research topics in the field of CS. In the course, various areas and current developments are presented and discussed. This includes fundamental knowledge, practical application, and hot research topics in the area of algorithms and data structures, databases, software testing, and software engineering.
Prerequisites	none
Content	• Software Engineering • Test Management • Data Management • Big Data / Data Science • Programming
Literature	• Current research paper
Media used	Script, projector
Form of Examination	EA/PA/BE
Language	English

Course Introduction to Scientific Communication

Module Name	Introduction to Scientific Communication
Module No.	2517
Unit/s	
Module Level	Master
Curriculum	1. Semester (Technology and Innovation Management (engl.) Regular Track only)
Credit Points (ECTS)	5 CP
Semester Working Hours	4 SWH Lecture (OR)
Workload	56h attendance, 69h self study
Module Responsible	Jutta Sendzik
Lecturer	Jutta Sendzik
Objective of the Module	Students understand that science communication is a multi-faceted notion. They know diverse communicative acts that are related to scientific knowledge or work, addressing professionals of their field or the public, intending to inform, influence, enlighten, argue or negotiate about science. The students will develop their presentation skills applying their knowledge about structuring, delivering as well as different presentation cultures. Students know how to use a reference management system. They apply core values of academic ethos and know how to avoid plagiarism.
Prerequisites	none
Content	• selecting content for and structuring a presentation • body language and voice power • creating meaningful slides • usage of reference management system Citavi • dealing with plagiarism
Literature	Leßmöllmann et al.: Science communication. Handbook of communication science. de Gruyter Inc. 2020 Olson, R.: Don't be such a scientist. Talking substance in an age of style. 2nd ed. Island Press 2018 Powel, M.: Dynamic presentations. CUP 2014
Media used	(e)textbooks, Internet, presentation software
Form of Examination	HA/RF/PA/K90/K60
Language	English

Course Operations Research and IT Security Risk Assessment

Module name	Operations Research and IT Security Risk Assessment
Module No.	2562
Unit/s	Operations Research (English) and IT Security Risk Assessment
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester working hours	2 SWH Lecture (OR), 2 SWH Lecture (IT Security)
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Tilla Schade
Lecturer	Prof. Dr. Tilla Schade (OR), N.N. (IT-Sec. RA)
Objective of the module	Students are able to model practical problems into graph theory problems. They do understand algorithms for determining Eulerian cycles, shortest paths and minimal spanning trees. Also, they know why the Travelling Salesman Problem is very difficult and are able to apply various methods for finding a good solution.
Prerequisites	
Content	Algorithm of Hierholzer for finding Eulerian trails and cycles, Breadth First Search and Algorithm of Dijkstra for determining shortest paths, Algorithm of Kruskal for determining minimal spanning trees, approximative and heuristic algorithms for solving the Travelling Salesman Problem, Branch and Bound method
Literature	• Jungnickel, Dieter: Graphs, Networks and Algorithms, Springer Verlag (2012) • Zimmermann, Hans-Jürgen: Operations Research, Vieweg Verlag (2007) • Domschke, Wolfgang und Drexl, Andreas: Einführung in Operations Research, Springer Verlag (2015)
Media used	Script, projector
Form of examination	K120/HA/RF/MP
Language	English

Course Research and Development Project (English)

Module name	Research and Development Project (English)
Module No.	2568
Lehrveranstaltungen	Project Work, Research Methods and Academic Writing and Paper Reading Group
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	15 CP
Semester working hours	3 SWH Lecture, 1 SWH Exercise, 4 SWH Lab
Workload	112 h attendance, 263 h self study
Module Responsible	Prof. Dr. Thomas Leich
Lecturer	Prof. Dr. Thomas Leich
Objective of the module	The student works alone on a scientific project of his choice under supervision. In addition knowledge of the relevant subject area, knowledge of scientific work as well as key and methodological skills (presentation, presentation of the current state of knowledge on the basis of a literature research, proposal to close the gap; Planning, implementation and interpretation of experiments, discussion, evaluation of scientific results, etc.) are provided. The possible subject areas can be innovation fields from the research focus of the corresponding supervising professor. Unit: Paper Reading Group Students read selected papers individually in preparation for the meeeting (a.k.a. Paper Reading Group). During the meeting, the student in charge will give a short presentation summarizing the paper and lead a discussion about the paper during the meeting. Unit: Research Methods and Academic Writing The participants of the lecture can • correctly classify sources and cite them accordingly, observing different citation styles • independently compose academic texts which stylistically and linguistically match the research standard on a Master level • explain, evaluate and apply research strategy and research processexplain, • evaluate and apply selected research design concepts • explain, evaluate and apply selected methods of qualitative and • quantitative research
Prerequisites	According to the chosen topic of the scientific project the student should have relevant knowledge in this field.
Content	Unit: Research Methods and Academic Writing: • Scientific project management • Literature research, quality assessment of scientific literature • Scientific publication system (conferences, journals, workshops, U) • Scientific writing • Scientific presentation • Academic Writing: Style, Citations, Paraphrasing, Punctuation, Literature Management • Research strategy and process • Research design (Experimental, cross sectional, longitudinal, case study, comparative) • Qualitative research (Action research, case study research, ethnographic research, grounded theory) • Quantitative research and mixed methods • Study design • Guidelines to ensure good scientific practice • Evaluation of scientific work (reviews) Unit: Project Work • Processing of a scientific project • Literature research • Presentation • Carrying out experiments/implementation of the idea as a prototype • Approaches to commercial exploitation • Discussion/defense of own results • Scientific writing • Independent work
Literature	• depending on the topic and research field
Media used	Script, projector
Form of examination	The examination is divided into 4 parts: • Defense of the project idea (15%) • Interim report (15%) • Final performance (55%) • Outlook, reflection, lessons learned (15%) The final presentation of the project includes a scientific elaboration (scientific paper) from at least 10 pages to a maximum of 15 pages.
Language	English

Course Strategic Innovation Management

Module Name	Strategic Innovation Management
Module No.	7994
Unit/s	Strategic Planning and Innovation Management
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture (Strategic Planning), 2 SWH Lecture (Innovation Management)
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Reynaldo Valle Thiele
Lecturer	Prof. Dr. Reynaldo Valle Thiele
Objective of the Module	Strategic Planning: Students know and understand: • the nature of strategy and different practices of performance evaluation • analysis of the relevant competitive environment of companies • Investigation of capabilities and resources within the company • Nature and sources of sustainable competitive advantages of different layors od strategy development Students acquire the following abilities: • Capture and systemize the complexity of strategy development • Analyzing and evaluate the relevant conditions of strategic management • Critical questioning the instruments of strateg. management and apply it to examples from corporate practice Innovation management: The students know and understand: • the need for and the nature of innovations • the classification of innovation management in corporate management • the concepts and strategies of innovation management • the resources and methods of innovation management • the organizational forms of innovation management The students acquire the skills: • Recognize and evaluate innovation opportunities • To transfer innovation needs into innovation projects • To acquire the necessary resources in the corporate environment • Developing innovation strategies and applying context-specific concepts and instruments for their implementation
Prerequisites	none
Content	Strategic planning process: • Nature of strategy, goals, values and performance, fundamentals of industry analysis, expansion of industry and competition analysis, analysis of resources and skills, nature and sources of competitive advantages, business strategies in different industries, diversification strategies, management of strategic change, current trends in the strategic management. Innovation management: • Generic innovation process, information search in practice, evaluation and selection of ideas, innovation strategies, financing of innovations, innovation cooperation (open innovation, lead-user approach), implementation of innovation projects, resistance to innovations, innovation culture, innovation project management.
Literature	• Tidd, J./ Bessant, J. (2013): Managing Innovation, 5. Edition, John Wiley & Sons • Grant, R.M. (2012): Contemporary Strategy Analysis, 8. Edition, John Wiley & Sons
Media used	Script, projector
Form of Examination	K120/ RF / HA
Language	English

Course Technology Assessment and Sustainability

Module Name	Technology Assessment and Sustainability
Module No.	2592
Unit/s	Technology Assessment and Sustainability
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 2 SWH Exercise
Workload	56 h attendance, 69 h self study
Module Responsible	Prof. Dr. Andrea Heilmann
Lecturer	Prof. Dr. Andrea Heilmann
Objective of the Module	The students know the essential methods of technology assessment and technology monitoring and are able to select and apply suitable methods. They can evaluate technological developments in consideration of sustainability criteria and derive recommendations for further action. They know selected methods in the field of sustainabality, their areas of application and can interpret the results. Students are able to analyse specific resources and derive suitable information. Students can evaluate innovative technologies in a project from an innovative and sustainable perspective and present the results.
Prerequisites	Basic Knowledge on environmental issues
Content	• Introduction in TAS • Analysis of megatrends as drivers of innovation • Methods of technology assessment and monitoring • Participatory technology development and assessment • Introduction to Sustainability • Methods for assessing sustainability • Sustainable Marketing
Literature	Script, selected scientific paper
Media used	Script, projector
Form of Examination	HA/RF/PA/K90/K60
Language	English

Elective Course Options

Course Virtual Reality/Augmented Reality and Mixed Reality Design

Module Name	Virtual Reality/Augmented Reality and Mixed Reality Design Elective Course/option1
Module No.	53760
Unit/s	
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWH Lecture, 1 SWH Exercise, 1 SWH Lab
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Simon Adler
Lecturer	Prof. Dr. Simon Adler
Aim of the Module	The students get insight into the design of xR technologies ranging from augmented to virtual reality. They will learn basics of geometric modeling and model optimization. They will learn about the tracking, projection and display technoligies and basic computer graphic skills. In the field of industrial-xR students get to know the value of xR in the industry and about connectivity of virtual with real components.
Prerequisites	Programming and/or Computer Graphics fundamentals
Content	• Basic terms and methods of xR • Basic methods of VR (rendering, realtime shader, tracking) as well as image processing
Literature	• J. LaViola et. al, 3D User Interfaces: Theory and Practice, Addison Wesley 2nd Edition, 2017
Media used	Script, projector, whiteboard
Form of Examination	K90/MP/EA/HA
Language	English

Course Smart Buildings: Smart Metering and Building Automation

Module Name	Elective course Option 2: Smart Buildings: Smart Metering and Building Automation
Module No.	53761
Unit/s	Smart Buildings: Smart Metering and Building Automation
Module Level	Master
Curriculum	Technology and Innovation Management
Credit Points (ECTS)	5 CP
Semester Working Hours	2 SWS lecture, 1 SWS exercise, 1 SWS laboratory
Workload	56h attendance, 69h self study
Module Responsible	Prof. Dr. Ulrich Fischer
Lecturer	Prof. Dr. Ulrich Fischer
Aim of the Module	Students know the basics and methods of elements and network technologies with a focus on smart home. Furthermore, they are able to apply techniques and concepts from the field of smart home engineering, components for smart homes, as well as technical innovation management and to integrate them into the construction of an overall system.
Prerequisites	Mathematics, physics, electrical engineering
Content	• Introduction • Basic transmission techniques • Basic network techniques • Components of the smart home applications • Functional safety (definition, examples, models, Standardization, limits, risk analysis, system behavior) • Relationship to IT security • Applications in the area of Ambient Assisted Living • Design and implementation of overall smart home systems
Literature	• Smart Homes, Nagender Kumar Suryadevara, Springer International Publishing 2015 • Ambient Assisted Living , Reiner Wichert, Helmut Klausing, 2014 • The Future of the Internet Gu nter Knieps 978-3-7489-0209-6 • Inside the Smart Home , Harper, Richard • E-Health: Datenschutz und Datensicherheit Christoph Bauer Springer 2018 • Smart Assisted Living: Toward An Open Smart-Home Infrastructure , Feng Chen , Springer; Auflage: 1st ed. 2020 (28. August 2019) • How AI Impacts Urban Living and Public Health, Lecture Notes in Computer Science José Pagán, Springer 2019 (https://www.springerprofessional.de/how-ai-impacts-urban-living-and-public-health/17251576) • IoT Platforms, Use Cases, Privacy, and Business Models, Carna Zivkovic, Springer International Publishing • An IoT Architecture of Microservices for Ambient Assisted Living Environments to Promote Aging in Smart Cities, Hubert Kenfack Ngankam, Springer Int. 2019 • Telemonitoring in Gesundheits- und Sozialsystemen : Eine eHealth-Lösung mit Zukunft / herausgegeben von Arnold Picot, Günter Braun Springer-Verlag Berlin Heidelberg, 2011 / Bertko, Chris. - München : Hanser, [2017] • Technisch unterstütztes Wohnen im Stadtquartier : Potentiale, Akzeptanz und Nutzung eines Assistenzsystems für ältere Menschen / Lynn Schelisch. - Wiesbaden : Springer VS, [2016]
Media used	Online presentation, virtual board, handouts, laboratory exercises
Form of Examination	RF, T (presentation, attestation for laboratory)
Language	English

Master's Degree

Course Master's Thesis

Module Name	Master's Thesis
Module No.	8000
Unit/s	
Module Level	Master
Curriculum	3. Semester (Technology and Innovation Management (engl.) Fast Track) 4. Semester (Technology and Innovation Management (engl.) Regular Track)
Credit Points (ECTS)	23 CP
Semester Working Hours	
Workload	575 h self study
Module Responsible	Prof. Dr. Thomas Leich
Lecturer	Lecturer Department AI
Objective of the Module	The students independently pursue a scientific question from the subject area of the master's course Technical Innovation Management and work on it within the specified deadline of 5 months. It is also possible to write the master's thesis as part of an integrated internship in a company or an authority, in case the student is working on a scientific relevant question. In doing so, the students develop their own ideas and concepts for solving scientific problems and deal in a more in-depth and critical manner with theories, terminologies/definitions, peculiarities, limits and possibly also different doctrines of the subject and reflect them.
Prerequisites	as per examination regulation
Content	
Literature	depending on the topic of the thesis
Media used	
Form of Examination	MA
Language	English

Course Colloquium (Thesis defense)

Module Name	Colloquium (Thesis defense)
Module No.	8010
Unit/s	
Module Level	Master
Curriculum	3. Semester (Technology and Innovation Management (engl.) Fast Track) 4. Semester (Technology and Innovation Management (engl.) Regular Track)
Credit Points (ECTS)	7 CP
Semester Working Hours	
Workload	210h self study
Module Responsible	Prof. Dr. Thomas Leich
Lecturer	Prof. Dr. Thomas Leich
Objective of the Module	Knowledge: Depending on the topic of the Master thesis and all other fields of the Master program Skills: Critical analysis and comparing analysis, summary and sharing of self estimated knowledge Competences: Design of a presentation , presentation skills, dramaturgy, rhetoric and free speech
Prerequisites	two indipendend assessments of the Master thesis, both showing a grade of min. 4.0
Content	In the colloquium the student presents the most important content of his Master thesis during a 30min public presentation; after the presentation the first examiner and the second examiner ask question concerning the thesis and questions out of the Master program within a non-public part. The colloquium has to be promulgated two weeks prior to the date in the university; it has to be the last exams of the Master program; all together the colloquium lasts about 45min (min 30min); the date of the colloquium is determined by the examiners
Literature	• depending on the topic of the Master thesis
Media used	projector and other media
Form of Examination	KO
Language	English

List of courses and units