Study regulations of the FH Master's course

Smart Products & AI-driven Development

To obtain the academic degree

Master of Science in Engineering
abbreviated MSc

as an appendix to the statutes of the FH Kufstein Tirol

Organizational form: full-time
Duration: 4 semesters
Scope: 120 ECTS
Places for beginners per academic year: 30 full-time

Content

1 OCCUPATIONAL PROFILES

1.1 Occupational fields

Graduates of the master's degree program in Smart Products & AI-driven Development are equipped with a broad-based technical and business education, enabling them to work across all industries that engage with smart products and their associated solutions.

However, there is particularly strong demand for professionals and managers in the following core industries:

- Mechanical and plant engineering
- Device manufacturing
- The automotive industry
- The energy sector
- Logistics and transportation
- Management consulting

The classification into specific industries is complicated by the advantageous fact that, due to technological transformation, smart products and associated solutions are becoming increasingly relevant across all types of enterprises. As a result, graduates can enter a wide variety of businesses and types of companies, as both large corporations and small to medium-sized enterprises are looking for qualified graduates with a background in engineering and technical sciences.

Given the program's aim to educate generalists, graduates' potential career paths are highly diverse. However, key characteristics of the professional fields include the following features:

- Graduates are likely to work in technically oriented roles at the interface between technological and business concerns.
- Graduates are ready to take on managerial responsibilities within the outlined field of work. This can happen both in freelance and entrepreneurial roles as well as within corporate structures at the middle and upper management levels.

Interviews with experts from five internationally active companies based in Tyrol revealed a broad spectrum of positions that graduates of this program can successfully fill, including:

- The development and implementation of smart products and solutions
- Automation and process optimization
- Data management and analysis
- Project management and interdisciplinary collaboration
- Artificial intelligence and machine learning
- Product development and design

After an initial onboarding phase, graduates are well-prepared to assume leadership roles. The following sections outline typical positions.

Technical Project Management

Technical Project Management encompasses managerial responsibilities across all technical domains. Project managers hold significant decision-making authority within their areas of responsibility.

Specific tasks in this role include:

- Acting as an interface between clients/experts and developers

- Drafting customer requirements specifications and technical documentation
- Contract management, as well as opportunities and risk management
- Coordinating projects and project communication
- Project-specific controlling and reporting
- Coordinating and leading company-internal project teams
- Representing projects vis-à-vis superiors and clients

Product Management

Product management is a multifaceted role that requires not only insights into market conditions and customer needs but also a deep understanding of the underlying technical details. Only this combination enables an alignment between what is technically feasible and what customers desire.

Specific tasks in this role include:

- Monitoring and evaluating market trends
- Monitoring and evaluating trends in customer needs
- Defining product requirements and enhancements
- Preparing customer requirements specifications, functional-technical specifications, and documentation
- Supporting development and ensuring required features are met
- Preparing product launches

Digital Transformation Management

The responsibilities of digital transformation managers are diverse and still evolving, given the relatively recent establishment of such roles in companies. Generally, these professionals play a transformative role, overseeing the digital aspects of business operations and guiding organizational development in response to digitalization demands.

Specific tasks in this role include:

- Developing a digitalization strategy
- Developing organizational structures and processes based on such a strategy
- Supporting its implementation at various levels
- Initiating and guiding process changes
- Supporting general organizational development
- Providing input for digital innovations

Innovation and Technology Management

This field focuses on understanding and evaluating technologies, architectures, and business models within the context of businesses' corporate and product strategies, market positioning, and competition dynamics.

Specific tasks in this role include:

- Monitoring and evaluating trends
- Monitoring, assessing, and developing new technologies
- Generating ideas and developing concepts
- Building early prototypes for validation
- Advising internal departments
- Conducting analyses and preparing customer requirements specifications and conceptual documents
- Performing feasibility studies, baseline analyses, and context analyses
- Presenting concepts and solutions

Technical Consulting

Technical consultants primarily advise industrial and commercial enterprises on technological innovations, applications, and the benefits of specific technical solutions. They develop technical concepts for clients and oversee their implementation.

Specific tasks in this role include:

- Providing consultancy services
- Acquiring and running consulting projects
- Conducting technical analyses and implementation tasks
- Specifying proposals
- Developing product strategies and feasibility studies
- Designing and implementing previously conceptualized requirements, including technical documentation
- Performing requirements analyses
- Drafting technical specifications
- Offering technical support across various stages of the value chain

Additional occupational fields

Product development
Entrepreneurship
Research in the field of smart products and solutions

1.2 Qualification profile

The qualification objectives and learning outcomes of the master's degree program in Smart Products & AI-driven Development meet relevant academic and professional requirements, as well as the requirements of *ISCED* (International Standard Classification of Education) *field 0788*.[1] The content taught qualifies graduates for the occupational fields mentioned in the previous section.

Occupational fields / competencies / modules

Occupational field	Task	Description of competency	Type of competency	Curriculum module(s)
Technical Project Management	Drafting of specifications	Can research customer requirements. Can draft customer requirements specifications. Can plan and monitor projects.	Professional-scientific	Product Development Product Management
	Setting up projects (goals, team, project plan)			
	Coordinating the project team	Can manage a team and overcome internal resistance.	Personal-social	Social Skills

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[1] *ISCED Manual*, Example 4: "A programme consisting of 40% engineering (071), 30% business (041) and 30% languages (023) should be classified as 0788 ("Inter-disciplinary programmes and qualifications involving engineering, manufacturing and construction") as no field predominates but 07 is the leading broad field. If engineering and business were equally important and greater than languages (e.g. 40%, 40% and 20%), the programme would be classified as either 0788 or 0488 depending on which programme, engineering (071) or business (041), is listed first in the programme title (or, if not in the title, in the curriculum or syllabus)."

	Communicating with stakeholders	Can communicate with customers.		
Product Management	Tracking market/customer trends	Can analyze trends.	Professional-scientific	Product Management
	Defining product requirements	Can assess and prioritize product requirements.		
	Creation of customer requirements specifications	Can draft customer requirements specifications.		
	Communicating with internal/external stakeholders	Can coordinate the internal departments involved in a project.	Personal-social	Social Skills
		Can present/pitch a product.		
Digital Transformation Management	Monitoring technological trends	Is familiar with current technological trends.	Professional-scientific	Digital Transformation
	Developing digitalization strategies			
	Recognizing digitalization potential	Can derive a digitalization strategy from company-divisional strategies.		
	Monitoring, coordinating, and managing the digitalization project portfolio	Can recognize potential for digitalization within a company.		
	Supporting the implementation of new solutions	Can monitor project portfolios.		
	Initiating, communicating, and convincing stakeholders of digitalization projects and solutions	Can inspire those affected regarding the potential of new projects.	Personal-social	Social Skills
Product Development	Developing smart products	Is familiar with technical solutions in the fields of sensor technology, data transmission, actuator technology, and embedded systems.	Professional-scientific	Data Management Product Development
	Translating requirements into technical specifications			
	Selecting a system architecture	Can evaluate and select IOT architectures.		
	Simulating and developing prototypes	Can generate product designs.		
	Preparation of feasibility studies			

		Can create and test prototypes.		
	Presenting product concepts	Can present convincingly.	Personal-social	Social Skills
Technical Consulting	Providing consultancy services on the selection of technical solutions	Is familiar with technical solutions in the field of smart products.	Professional-scientific	Digital Transformation Product Development Data Management Product Management
	Development of product strategies and feasibility studies	Can create concepts from client requirements.		
	Mapping out solutions	Can define product strategies.		
		Can assess the quality and risks of solutions.		
	Creation of technical documentation	Can draft technical documentation.		

2 CURRICULUM

2.1 Curriculum Data

	Full-time	Comments, if any
Year of first implementation (YYYY/YYYY+1)	2025/2026	
Standard duration of program (Number of semesters)	4	
SWS (Semester Hours) (Total of all semesters)	48.5	
ECTS Points (Total of all semesters)	120	
Start of Winter Term (CW = Calendar Week)	CW 40	
End of Winter Term (CW = Calendar Week)	CW 5	
Start of Summer Term (CW = Calendar Week)	CW 11	
End of Summer Term (CW = Calendar Week)	CW 28	
Number of weeks in Winter Term	15	
Number of weeks in Summer Term	15	
Compulsory semester abroad	No	
Language of instruction	English	
Internship	No	

2.2 Curriculum matrix

The curriculum matrix contains courses that will be available to students as electives; these courses will be offered jointly with the English-language master's degree program in Data Science & Intelligent Analytics. In the third semester, students choose two courses from a selection of two bundles of courses. In the fourth semester, they choose one course from a selection of two further courses. The choices are as follows:

The first compulsory elective in the 3rd semester is selected from the following bundle (Students select one of the two courses):

- Digital Twin & Simulation
- Data Visualization & Visual Analytics

The second compulsory elective in the 3rd semester is selected from the following bundle (Students select one of the two courses):

- Application-Oriented Analysis Platforms
- Internet of Things

The compulsory elective in the 4th semester is selected from the following bundle (Students select one of the two courses):

- Trends in Data Science
- Trends in Smart Products

1. Semester

Course no.	Course title	LV-Typ	T	E	WSH	No. of groups	ASWS	ALVS	MODUL	ECTS
DAT.1	Coding & Applied AI	ILV	X	X	2.5	1	2.5	37.5	DAT	5
DIT.1	Digital Transformation & Change Management	ILV		X	2.5	1	2.5	37.5	DIT	5
DIT.4	Fundamentals of AI	ILV	X	X	2.5	1	2.5	37.5	DIT	5
PDE.1	Smart Product Development	ILV	X	X	2.5	1	2.5	37.5	PDE	5
PDE.2	Sensors & Actuators	ILV	X	X	2.5	1	2.5	37.5	PDE	5
PDE.3	Embedded Systems & Edge Analytics	ILV	X	X	2.5	1	2.5	37.5	PDE	5
Total line:					15.0		15.0	225.0		30
Course hours = Total WSH x course weeks					225.0					

2. Semester

Course no.	Course title	LV-Typ	T	E	WSH	No. of groups	ASWS	ALVS	MODUL	ECTS
DAT.2	Connectivity & Security	ILV	X	X	2.5	1	2.5	37.5	DAT	5
PDE.5	AI-based Product Design	ILV	X	X	2.5	1	2.5	37.5	PDE	6
PDE.6	Rapid Prototyping	ILV	X	X	2.5	1	2.5	37.5	PDE	6
PRM.2	Risk Management & Compliance	ILV		X	2.5	1	2.5	37.5	PRM	5
PXT.1	Study trip	ILV	X	X	2	1	2	30	PXT	3
SSK.1	Project Management & Team Leadership	ILV		X	2.5	1	2.5	37.5	SSK	5
Total line:					14.5		14.5	217.5		30
Course hours = Total WSH x course weeks					217.5					

3. Semester

Course no.	Course title	LV-Typ	T	E	WSH	No. of groups	ASWS	ALVS	MODUL	ECTS
DAT.3	Data Analytics & Visualization	ILV	X	X	2.5	1	2.5	37.5	DAT	5
DIT.2	Strategy & Business Model & Organisation	ILV		X	1	1	1	15	DIT	2
MA.1	Research Methods	SE		X	1	1	1	15	MA	2
PDE.7	Manufacturing & Material Science for Smart Products	ILV	X	X	2.5	1	2.5	37.5	PDE	5
PRM.1	Product Management	ILV		X	1.5	1	1.5	22.5	PRM	3
PXT.2	Business Project	PT	X	X	2	2	4	60	PXT	5
WPF.2	Application-oriented analysis platforms (elective)*	ILV		X	2	1	2	30	WPF	4
WPF.3	Internet of Things (elective)*	ILV	X	X	2	1	2	30	WPF	4
WPF.6	Data Visualization & Visual Analytics (elective) (WP)*	ILV	X	X	2	1	2	30	WPF	4
WPF.7	Digital Twin & Simulation (WP)*	ILV		X	2	1	2	30	WPF	4
Total line:					14.5		16.5	247.5		30
Course hours = Total WSH x course weeks					217.5					

4. Semester

Course no.	Course title	LV-Typ	T	E	WSH	No. of groups	ASWS	ALVS	MODUL	ECTS
DIT.3	Ethics & Privacy	ILV		X	1.5	1	1.5	22.5	DIT	3
MA.2	Master Thesis Colloquium	SE		X	1	1	1	15	MA	2
MA.3	Master thesis	UE		X	0	1	0	0	MA	22
WPF.10	Trends in Data Science (elective) (WP)*	ILV		X	2	1	2	30	WPF	3
WPF.11	Trends in Smart Products (elective) (WP)*	ILV		X	2	1	2	30	WPF	3
Total line:					4.5		4.5	67.5		30
Course hours = Total WSH x course weeks					67.5					

((ad 4th semester))
The course on "Trends" is offered as an elective jointly with the master's degree program Data Science & Intelligent Analytics. Students choose one course on trends in a specific field, which they then complete as a compulsory elective.

* The 22 ECTS credits allocated to the master's thesis are further divided into 20 ECTS credits allocated to the written master's thesis as such, and 2 ECTS credits allocated to the final comprehensive master's examination.

The following presentation of courses does not include the workload for the supervision of master's theses. A workload of 0.6 SWS is planned for each supervised thesis, i.e., the 30 accredited degree program places would result in an additional ASWS workload of 18 ASWS, which is incurred in the 4th semester.

Abbreviations	
E	Lecture in English language
ECTS	ECTS – Credit points
LV	Course
LVS	Course hour(s)
WSH	Weekly semester hour(s)
T	Lecture with technical background
WP	Elective subject

Summary curriculum data

Description	WSH	ASWS	ALVS	ECTS
Total number of courses over all semesters	48.5	50.5	757.5	120
Total number of courses in 1st year of study	29.5	29.5	442.5	60
Total number of courses in 2nd year of study	19	21	315	60
Total number of courses in 3rd year of study				
Total number of technical events over all semesters	31			64

Percentage of technical courses over all semesters based on WSH / ECTS	63.92 %			53.33 %
Total number of courses in English over all semesters	48.5			120
Proportion of courses in English over all semesters based on WSH / ECTS	100 %			100 %

2.3 Module descriptions

Module number:	Product Development	Scope:	
PDE		32	ECTS
Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time		
Position in the curriculum	1. Semester		
	2. Semester		
	3. Semester		
Level	1. Semester: second cycle, Master / 1. Semester: Second cycle, Master / 2. Semester: second cycle, Master / 2. Semester: second cycle, Master / 3. Semester: -		
Previous knowledge	1. Semester: according to admission requirements / 1. Semester: according to admission requirements / 2. Semester: none / 3. Semester: none		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Smart Product Development /ILV / LV-Nr: PDE.1 / 1.Semester / ECTS: 5 Arreola-Risa, A.; Designing Supply Chains for New Product Development; 2013 Golder, P.N., Mitra D.; Handbook of Research on New Product Development; 2018 Mihm J.; Complexity in New Product Development Mastering the Dynamics of Engineering Projects; 2012 Smith P.G.; Flexible Product Development - Building Agility for Changing Markets; 2007 Douglass, B. P.; Agile model-based systems engineering cookbook : improve system development by applying proven recipes for effective agile systems engineering; 2021 Dori, D.; Object-process methodology : a holistics systems paradigm; 2002 Sensors & Actuators /ILV / LV-Nr: PDE.2 / 1.Semester / ECTS: 5 Czichos H.; Mechatronik: Grundlagen und Anwendungen technischer Syste- me; Wiesbaden; 2019, 4th edition Heinrich B., Linke P., Glöckler M.; Grundlagen Automatisierung: Sensorik, Regelung, Steuerung; Wiesbaden; 2017, 2nd edition Tränkler H., Reindl L.; Sensortechnik: Handbuch für Praxis und Wissenschaft; Berlin; 2018, 2nd edition Embedded Systems & Edge Analytics /ILV / LV-Nr: PDE.3 / 1.Semester / ECTS: 5 Marwedel, P.: Embedded system design : embedded systems foundations of cyber-physical systems, and the Internet of Things; 2021 Heath, S.; Embedded systems design; 2003 Ganssle, J. G.; The art of designing embedded systems; 2000 AI-based Product Design /ILV / LV-Nr: PDE.5 / 2.Semester / ECTS: 6 Gerhard H., Lanz M., Prettenthaler M.; Design Basics: von der Idee zum Produkt; 2018 Follet J.; Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things; 2014 Rapid Prototyping /ILV / LV-Nr: PDE.6 / 2.Semester / ECTS: 6		

	Bryden D.; CAD and Rapid Prototyping for Product Design; London; 2014 Gebhardt A.; Additive Fertigungsverfahren : Additive Manufacturing und 3D-Drucken für Prototyping - Tooling – Produktion; München; 2016 Runco M. A.; Creativity : Theories and Themes: Research, Development, and Practice; Amsterdam; 2007
	Manufacturing & Material Science for Smart Products /ILV / LV-Nr: PDE.7 / 3.Semester / ECTS: 5 Runco M. A.; Creativity : Theories and Themes: Research, Development, and Practice; Amsterdam; 2007 Wypych G.; Handbook of Polymers for Electronics; 2021 Edwards P.; Manufacturing Technology in the Electronics Industry; 2021 Proes F.W.; Additive Manufacturing of Mechatronic Integrated Devices; 2022
Acquisition of skills	Smart Product Development /ILV / LV-Nr: PDE.1 / 1.Semester / ECTS: 5 The graduate, the student: * Knows different approaches to the product development process * Knows traditional and agile product development methods as well as the dependencies of the process on product type, batch size and other dependencies *Can name the different phases of the product development process and derive necessary activities *Knows AI-based tools for solving problems in the product development process * Knows systematic methods of product development for the different phases of the overall process * Can define a smart communicating product * Is familiar with the concepts of digital twin, condition monitoring, predictive maintenance * Knows the specific challenges of smart products and their influence on the product development process

Acquisition of skills	**Sensors & Actuators /ILV / LV-Nr: PDE.2 / 1.Semester / ECTS: 5** The graduate / the student: * knows the process chain between sensors and actuators * can characterize the wide range of sensors * can formulate advantages and disadvantages of different sensors for a given application and select sensors suitable for the application * acquires the ability to describe the structure of sensors, interpret data sheets and carry out measurements * can interpret measurement results and know their formats in order to optimize further data processing
	Embedded Systems & Edge Analytics /ILV / LV-Nr: PDE.3 / 1.Semester / ECTS: 5 The graduate / the student: * knows the architecture and components of embedded systems and can justify the advantages and disadvantages of different designs * knows the development process and tools * can define the requirements for an embedded system, evaluate concepts and make a selection * is able to set up the development environment for an embedded system * is able to create and implement simple programs regarding control, processing of sensor data, control of actuators and communication
	AI-based Product Design /ILV / LV-Nr: PDE.5 / 2.Semester / ECTS: 6 The graduate / the student: * can explain design guidelines and contexts for product design * can develop concepts based on requirements and evaluate them * can independently carry out an industrial design project * can use the necessary tools, such as generative AI, correctly
	Rapid Prototyping /ILV / LV-Nr: PDE.6 / 2.Semester / ECTS: 6 The graduate / the student: * knows common prototyping technologies * can apply them fundamentally * can create a simple digital model
	Manufacturing & Material Science for Smart Products /ILV / LV-Nr: PDE.7 / 3.Semester / ECTS: 5 The graduate / the student: •gain understanding of manufacturing and assembly processes in product development •able to select appropriate materials for different product applications •understand how material science influences product design and manufacturing •explore sustainable manufacturing practices and how to incorporate eco-friendly materials and processes into product development •be introduced to manufacturing technologies such as additive manufacturing (3D printing), nanotechnology, and smart materials •gain skills in cost-benefit analyses of manufacturing processes and material choices •learn about quality control measures and testing protocols
Course contents	**Smart Product Development /ILV / LV-Nr: PDE.1 / 1.Semester / ECTS: 5** * Types of product development processes for different products, markets and companies *Traditional PE vs. Agile PE vs. Mixed - which concept under which conditions *Design Thinking as a central development concept *Methods of product development: •Ideating and creative methods for solving problems like: Ishikawa, root-course, risk management, functional analysis, SWOT, FMEA,….. •Requirements engineering •Market and patent analysis •Concept •Systematical finding of technical solutions using AI •Evaluation of ideas and concepts •Design •Simulation of functional aspects (stress/strain, displacements, movement,….) •Prototyping •Testing *Special aspects of smart products
	Sensors & Actuators /ILV / LV-Nr: PDE.2 / 1.Semester / ECTS: 5

	* Definition/classification of sensors * Structure and function of a measuring chain * Fields of application and functional principles of sensors * Basics of microsensors * Sensor properties (static and dynamic behavior, reliability, etc.) * Measurement errors and sources of error * Calibration * Signal transmission/processing

Course contents	* Basic terms of relevant measurement technology * Application of sensors for different areas (e.g. temperature, weight, pressure, acceleration, position, etc.) * Analysis and evaluation of functional principles and sensor properties * Structure and properties of data transmission and data processing in a measurement chain * Evaluation, interpretation and storage of measurements
	Embedded Systems & Edge Analytics /ILV / LV-Nr: PDE.3 / 1.Semester / ECTS: 5 • System solutions and architecture of embedded systems and characteristics • Embedded hardware (processors, memory, I/O, busses) • Embedded software (operating system, middleware, application, drivers) • Real-time operation (classification, implementation) • Multi-processor operation • Getting to know simple platforms (e.g. Raspberry Pi, Arduino, FPGA) and the development environment • Implementing simple use cases concerning the processing of sensors and the control of actuators • Implementing different possibilities of data transmission • Realization of a more complex final project
	AI-based Product Design /ILV / LV-Nr: PDE.5 / 2.Semester / ECTS: 6 * Definition/delimitation of product design * Classification in the product development process * Procedure, approaches/principles and tools for product design with focus on generative AI * Evaluation criteria and the evaluation of developed or existing concepts
	Rapid Prototyping /ILV / LV-Nr: PDE.6 / 2.Semester / ECTS: 6 Prototyping Technologies * Laser engravers (Lasercut) * Additive manufacturing methods (e.g. 3D printing) * Digital prototypes (e.g. Click Dummies for Apps) * Scan technologies * Basics of CAx * Virtual prototyping Protoyping Concepts * Design thinking * Creativity methods Creating a Prototype
	Manufacturing & Material Science for Smart Products /ILV / LV-Nr: PDE.7 / 3.Semester / ECTS: 5 • Understanding Manufacturing Processes and Assembly Techniques • Material Selection and Application • Integration of Material Science in Design • Sustainability in Manufacturing • Innovative Manufacturing Technologies • Cost Analysis and Efficiency • Quality Control and Testing
Teaching and learning methods	Smart Product Development /ILV / LV-Nr: PDE.1 / 1.Semester / ECTS: 5 Lecture, group work, presentation and discussion of tasks
	Sensors & Actuators /ILV / LV-Nr: PDE.2 / 1.Semester / ECTS: 5 Lecture, group work, presentation and discussion of tasks
	Embedded Systems & Edge Analytics /ILV / LV-Nr: PDE.3 / 1.Semester / ECTS: 5 Lecture, individual work with software, group work, presentation and discussion of tasks
	AI-based Product Design /ILV / LV-Nr: PDE.5 / 2.Semester / ECTS: 6 Lecture, individual work with software, group work, presentation and discussion of tasks
	Rapid Prototyping /ILV / LV-Nr: PDE.6 / 2.Semester / ECTS: 6 English version available soon
	Manufacturing & Material Science for Smart Products /ILV / LV-Nr: PDE.7 / 3.Semester / ECTS: 5 Lecture, group work, presentation and discussion of tasks
Evaluation Methods Criteria	Smart Product Development /ILV / LV-Nr: PDE.1 / 1.Semester / ECTS: 5 Written exam, presentation
	Sensors & Actuators /ILV / LV-Nr: PDE.2 / 1.Semester / ECTS: 5 Exam

	Embedded Systems & Edge Analytics /ILV / LV-Nr: PDE.3 / 1.Semester / ECTS: 5
	Examination, project

Evaluation Methods Criteria	AI-based Product Design /ILV / LV-Nr: PDE.5 / 2.Semester / ECTS: 6 Project
	Rapid Prototyping /ILV / LV-Nr: PDE.6 / 2.Semester / ECTS: 6 English version available soon
	Manufacturing & Material Science for Smart Products /ILV / LV-Nr: PDE.7 / 3.Semester / ECTS: 5 written exam

Module number:	Digital Transformation	Scope:	
DIT		15	ECTS
Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time		
Position in the curriculum	1. Semester		
	3. Semester		
	4. Semester		
Level	1. Semester: second cycle, Master / 1. Semester: Second cycle, Master / 3. Semester: second cycle, Master / 4. Semester: second cycle, Master		
Previous knowledge	1. Semester: - / 1. Semester: according to admission requirements / 3. Semester: - / 4. Semester: English version available soon		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Digital Transformation & Change Management /ILV / LV-Nr: DIT.1 / 1.Semester / ECTS: 5 Caudron J., Van Peteghem D.V.; Digital Transformation: A Model to Master Digital Disruption; BookBaby; 2016 Rauser A.; Digital Strategy: A Guide to Digital Business Transformation; North Carleston; 2016 Doppler K., Lauterburg Ch.; Change Management: Den Unternehmenswandel gestalten; Campus, 13. Auflage, 2014 Berner W., Change!: 15 Fallstudien zu Sanierung, Turnaround, Prozessoptimierung, Reorganisation und Kulturverän-derung, Schäfer Poschl, 2. Auflage, 2015 Kotter J.P.; Leading Change; Harvard, 2011 Strategy & Business Model & Organisation /ILV / LV-Nr: DIT.2 / 3.Semester / ECTS: 2 Clement R., Schreiber D.; Internet-Ökonomie: Grundlagen und Fallbei- spiele der vernetzten Wirtschaft; Berlin; 2016 3. Auflage Hoffmeister Ch.; Digital Business Modelling: Digitale Geschäftsmodelle entwickeln und strategisch verankern; Mün-chen; 2015 McGrath R. G.; The End of Competitive Advantage: How to Keep Your Strategy Moving as Fast as Your Business; Massachusetts; 2013 Ries E.; The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses; St. Ives; 2013 Slama D., Puhlmann F., Mirrish J., Bhatnagar R.; Enterprise IoT: Strategies and Best Practices for Connected Prod-ucts and Services; 2015 Ethics & Privacy /ILV / LV-Nr: DIT.3 / 4.Semester / ECTS: 3 Heesen J. (publisher); Handbuch Medien- und Informationsethik; Stuttgart; 2016 Davisson A., Booth P. (publisher); Controversies in Digital Ethics; New York; 2016 Ess C.; Digital Media Ethics; Cambridge; 2014 Fundamentals of AI /ILV / LV-Nr: DIT.4 / 1.Semester / ECTS: 5 Patrick D. Smith. (2018). Hands-on artificial intelligence for beginners : an introduction to AI concepts, algorithms, and their implementation (1st edition.). Géron, A. (2023). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: concepts, tools, and tech-niques to build intelligent systems (Third edition). Park, K. R., Kim, E., & Lee, S. (2023). Image and Video Processing and Recognition Based on Artificial Intelligence. (Volume II).		
Acquisition of skills	Digital Transformation & Change Management /ILV / LV-Nr: DIT.1 / 1.Semester / ECTS: 5 The graduate / the student: * knows significant trends in the field of digitalization for companies * can evaluate the potential that digital transformation offers companies and describe development paths for their own company * knows the challenges that digital transformation poses to traditional companies * knows the importance of smart products in the context of digitalization * can derive a digitalization strategy from a divisional strategy * knows the importance of change management for the introduction of products / services * knows the most important approaches, models and terms * understands the individual and social aspects of change and knows the main causes of resistance and conflicts * knows procedural models or methods, techniques and tools for change management * can integrate the topic of change management in change projects and can apply procedural models or methods, techniques and tools to specific practical cases Strategy & Business Model & Organisation /ILV / LV-Nr: DIT.2 / 3.Semester / ECTS: 2		

	The graduate / the student: • understands the basics of the digital economy • knows the relationships between strategy, business model, business process model and process and methods to develop them • knows the requirements and elements of a business plan and can evaluate it • can develop business models suitable for identified framework conditions and transfer them into a business process model • is able to develop a business plan based on this

Acquisition of skills	Ethics & Privacy /ILV / LV-Nr: DIT.3 / 4.Semester / ECTS: 3 The graduate / the student: * has a good understanding of the fundamental laws, regulations and strategies in data protection * can explain basic positions of technical and business ethics using examples * can describe the steps of ethical judgement and argumentation and apply them in case studies from economic and technical practice * know the effects of technological change on work-life balance and family
	Fundamentals of AI /ILV / LV-Nr: DIT.4 / 1.Semester / ECTS: 5 The students: * understand the basics of artificial intelligence * are able to identify areas of application for artificial intelligence * are able to create content (text, images, audio) using artificial intelligence * can assess the advantages and disadvantages of artificial intelligence in the development of smart products * know restrictions and limitations of artificial intelligence
Course contents	Digital Transformation & Change Management /ILV / LV-Nr: DIT.1 / 1.Semester / ECTS: 5 • Digital trends and waves of change • Difference between digital and traditional companies or their development paths • Design levels, framework conditions and challenges of digital change • Frameworks for the assessment of digital maturity • Smart products • Development • Ecosystem IoT and data • Use cases of smart products and solutions * Importance of change management * Individual and social aspects of change * Resistance, conflict and crisis * Basic approaches to change management * Types of change * Models of change (e.g. Lewin, GE-CAP, etc.) * (Project) management of change: Generic phase * Models of change (e.g. Lewin, GE-CAP, etc.) * (Project) management of change: Generic phase model and integration in projects * Techniques and tools of change (e.g: Target circle, change stretch, WIIFM, empathy map, etc.)
	Strategy & Business Model & Organisation /ILV / LV-Nr: DIT.2 / 3.Semester / ECTS: 2 * Fundamentals of the digital economy and trends * Digital business models * Importance of data * Approaches to developing strategies, business models and business process models * Business plans * Risk reduction/implementation
	Ethics & Privacy /ILV / LV-Nr: DIT.3 / 4.Semester / ECTS: 3 * Introduction to data protection and its implementation * Definitions: personal data, data registers, publicly accessible data, pseudonymization * Informational self-determination, laws and regulations on data protection * Rights of those concerned * Organizational measures for the protection of personal data * Criminal/civil law aspects: Trade secrets, refusal to testify * Introduction to ethics as the science of good and right decisions and actions * Relevant factors of ethical judgement * Methods of ethical argumentation * Concept of responsibility * Business and technical ethics as sub-disciplines of ethics * Ethical challenges in digitalized and global information and knowledge societies * Effects of technological change on work life balance and family
	Fundamentals of AI /ILV / LV-Nr: DIT.4 / 1.Semester / ECTS: 5

	* Basics of artificial intelligence - Overview of terms and definitions - Basic algorithms and models * Application areas of AI - Identification and evaluation of application areas in the context of the product development process of smart products - Limitations of AI * Applications of generative AI - Generation and modification of texts - Generation and modification of images and videos - Audio generation and modification - Prompting strategies (e.g. retrieval augmented prompting) * Implementation of AI - Use and interaction with AI - Local vs. Hosted AI Models

Course contents	- Quality assurance of AI models * Restrictions and limitations - Ethical considerations and implications when using AI models
Teaching and learning methods	**Digital Transformation & Change Management /ILV / LV-Nr: DIT.1 / 1.Semester / ECTS: 5** Lecture, group work, presentation and discussion of tasks **Strategy & Business Model & Organisation /ILV / LV-Nr: DIT.2 / 3.Semester / ECTS: 2** Lecture, group work, presentation and discussion of tasks **Ethics & Privacy /ILV / LV-Nr: DIT.3 / 4.Semester / ECTS: 3** Lecture, group work, presentation and discussion of tasks **Fundamentals of AI /ILV / LV-Nr: DIT.4 / 1.Semester / ECTS: 5** Lecture, individual work with software, group work, presentation and discussion of tasks
Evaluation Methods Criteria	**Digital Transformation & Change Management /ILV / LV-Nr: DIT.1 / 1.Semester / ECTS: 5** Examination, Seminar thesis **Strategy & Business Model & Organisation /ILV / LV-Nr: DIT.2 / 3.Semester / ECTS: 2** Examination and presentation **Ethics & Privacy /ILV / LV-Nr: DIT.3 / 4.Semester / ECTS: 3** exam **Fundamentals of AI /ILV / LV-Nr: DIT.4 / 1.Semester / ECTS: 5** Project work and presentation

Module number:	Data Management	Scope:	
DAT		**15**	**ECTS**
Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time		
Position in the curriculum	1. Semester		
	2. Semester		
	3. Semester		
Level	1. Semester: second cycle, Master / 2. Semester: second cycle, Master / 3. Semester: second cycle, Master		
Previous knowledge	1. Semester: English version available soon / 2. Semester: none / 3. Semester: none		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Coding & Applied AI /ILV / LV-Nr: DAT.1 / 1.Semester / ECTS: 5 Ziadé, T.; Expert Python programming learn best practices to designing, coding, and distributing your Python software; 2008 Nguyễn, Q.; Hands-on application development with pycharm : accelerate your python applications using practical coding techniques in pycharm; 2019 Anaya, M.; Clean code in Python : develop maintainable and efficient code; 2020 Perrotta P.; Machine Learning für Softwareentwickler: Von der Python-Codezeile zur Deep-Learning-Anwendung; 2020		
	Connectivity & Security /ILV / LV-Nr: DAT.2 / 2.Semester / ECTS: 5 Badach A., Hoffmann E.; Technik der IP-Netze: Internet-Kommunikation in Theorie und Einsatz; München; 2019, 4. Auflage Freyer U.; Nachrichten-Übertragungstechnik: Grundlagen, Komponenten, Verfahren und Anwendungen der Informations-, Kommunikations- und Medientechnik; München; 2017, 7. Auflage Gessler R., Krause Th.; Wireless-Netzwerke für den Nahbereich: Eingebettete Funksysteme: Vergleich von standardisierten und proprietären Verfahren; Wiesbaden; 2015, 2. Auflage Tanenbaum A.S., Wetherall D.J.; Computernetzwerke; München; 2012, 5. Auflage		
	Data Analytics & Visualization /ILV / LV-Nr: DAT.3 / 3.Semester / ECTS: 5 Runkler Th.; Information Mining; vieweg; 2000 Langit L.; Smart Business Intelligence Solutions with Microsoft SQL Server; Microsoft Press; 2008 Petersohn H.; Data Mining; Oldenbourg; 2005 Provost F., Fawcett T.; Data Science for Business; O'Reilly; 2013 Milton M.; Head First Data Analysis; O'Reilly; 2009		
Acquisition of skills	Coding & Applied AI /ILV / LV-Nr: DAT.1 / 1.Semester / ECTS: 5 The graduate / the student: * has an overview of programming languages * knows the structure and structure of programs * can create programs in a high-level language * can use the development environment for a programming language * can implement manageable problems in a program * can use generative language models to produce program code		
	Connectivity & Security /ILV / LV-Nr: DAT.2 / 2.Semester / ECTS: 5 English version available soon		
	Data Analytics & Visualization /ILV / LV-Nr: DAT.3 / 3.Semester / ECTS: 5 The graduate / student:* can describe the contents, results/applications and working methods of Data Science * can convert "questions" into requirements in the context of Data Science * can define the process and tools based on these and implement / use them * knows a software with libraries for implementing data analysis and evaluation * can use appropriate software * can carry out suitable evaluations and analyses using the software for defined examples		
Course contents	Coding & Applied AI /ILV / LV-Nr: DAT.1 / 1.Semester / ECTS: 5		

	* Programming languages (classification, principles, history) * Detailed consideration of a modern programming language (e.g. Phyton) * Overview and selection of a coding assistant * Structure of programs * Data types, operators, flow structures * Development environment * Typical work steps * Setting up the development environment * AI enabled Programming (input, debugging, execution) * Independent planning and programming based on the programming languages taught in the lecture * Development of AI-enhanced programs
	Connectivity & Security /ILV / LV-Nr: DAT.2 / 2.Semester / ECTS: 5 * Fundamentals of data transmission * Wired data transmission * Wireless communication * Technologies and applications of modern networks

Course contents	* OSI, hybrid and TCP/IP reference model * Wired data transmission (I2C communication, serial communication) * Wireless networks * Sensor networks and approaches (e.g. MANET, WMN) * End-to-end protocols: UDP, TCP * Selected protocols of the application layer (e.g. FTP, HTTP, HTTPS, SMTP, MQTT) * Security concepts and access procedures * Release updates for networks * Elements of a measurement report * Selection of transmission technologies and protocols
	Data Analytics & Visualization /ILV / LV-Nr: DAT.3 / 3.Semester / ECTS: 5 * Introduction (data, information, knowledge, temporal components, objectives) * Data process (collection, preparation, analysis, presentation) * Data preparation (cleansing, transformation, rescaling, storage) * Approaches for the analysis of data * Presentation/visualization of results * Software (open source and proprietary software) * Machine Learning - process, approaches, implementation * Introduction to the software used e.g. Python * Collecting and preparing data using software * Analysis and presentation of sample data using various approaches (e.g. regression, decision trees, etc.)
Teaching and learning methods	Coding & Applied AI /ILV / LV-Nr: DAT.1 / 1.Semester / ECTS: 5 Lecture, individual work with software, group work, presentation and discussion of tasks
	Connectivity & Security /ILV / LV-Nr: DAT.2 / 2.Semester / ECTS: 5 Lecture, group work, presentation and discussion of tasks
	Data Analytics & Visualization /ILV / LV-Nr: DAT.3 / 3.Semester / ECTS: 5 Lecture, individual work with software, group work, presentation and discussion of tasks
Evaluation Methods Criteria	Coding & Applied AI /ILV / LV-Nr: DAT.1 / 1.Semester / ECTS: 5 Exam
	Connectivity & Security /ILV / LV-Nr: DAT.2 / 2.Semester / ECTS: 5 exam
	Data Analytics & Visualization /ILV / LV-Nr: DAT.3 / 3.Semester / ECTS: 5 exam

Module number:	Social Skills	Scope:	
SSK		5	ECTS
Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time		
Position in the curriculum	2. Semester		
Level	2. Semester: -		
Previous knowledge	2. Semester: none		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Project Management & Team Leadership /ILV / LV-Nr: SSK.1 / 2.Semester / ECTS: 5 Barker St., Cole R.; Brilliant Project Management, What the best project managers know, do and say; Pearson; 2012 Ding R.; Key Project Management based on effective project thinking; Springer; 2019 Karlgaard R., Malone M.S.; Team Genius: The New Science of High Performing Organisations; 2015 Marle F., Vidal A.; Managing complex, high risk projects, Springer; 2016 Schwindt Ch., Zimmermann J.; Handbook on Project Management and Scheduling Vol 2; Springer; 2015 N.N.; PMBOOK guide; A guide to the project management body of knowledge; Project Management Institute; 2013 Roudias J.; Mastering principles and practices in PMBOK, PRINCE2, and Scrum; Pearson FT Press; 2013		
Acquisition of skills	Project Management & Team Leadership /ILV / LV-Nr: SSK.1 / 2.Semester / ECTS: 5 The graduate / the student: * can apply the approaches, functions, methods and tools of project management * can work, organize and form teams in a project-oriented way and lead them appropriately * knows tools and documentation standards * can apply PM tools and standards * knows frameworks for project management * knows the basic communication, moderation and negotiation techniques as well as the most important leadership tools * can use these tools in steering project teams and coordinating with stakeholders in a way that is appropriate for the situation and the employees * can monitor project portfolios		
Course contents	Project Management & Team Leadership /ILV / LV-Nr: SSK.1 / 2.Semester / ECTS: 5 * Basics of project management * Project management methods and tools * Roles in projects; communication and documentation * Problem, conflict, risk and crisis management * Theories/models and procedures for teambuilding * Tools for supporting teambuilding		
Teaching and learning methods	Project Management & Team Leadership /ILV / LV-Nr: SSK.1 / 2.Semester / ECTS: 5 Lecture, group work, presentation and discussion of tasks		
Evaluation Methods Criteria	Project Management & Team Leadership /ILV / LV-Nr: SSK.1 / 2.Semester / ECTS: 5 Project		

Module number:	Product Management	Scope:	
PRM		8	ECTS
Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time		
Position in the curriculum	2. Semester		
	3. Semester		
Level	2. Semester: second cycle, Master / 3. Semester: second cycle, Master		
Previous knowledge	2. Semester: - / 3. Semester: according to admission requirements		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Product Management /ILV / LV-Nr: PRM.1 / 3.Semester / ECTS: 3 Aumayr K.J.; Erfolgreiches Produktmanagement: Tool-Box für das professionelle Produktmanagement und Produktmarketing; Wiesbaden; 2019 5. Auflage Hermann A., Albers S.; Handbuch Produktmanagement: Strategieentwicklung – Produktplanung – Organisation – Kontrolle; Wiesbaden; 2018 7. Auflage Pichler R.; Agiles Produktmanagement mit Scrum: Erfolgreich als Product Owner arbeiten; Heidelberg; 2013 2. Auflage		
	Risk Management & Compliance /ILV / LV-Nr: PRM.2 / 2.Semester / ECTS: 5 Börcsök, J.; Functional Safety: Basic Principles of Safety-related Systems; 2020 Kobes, P; Guideline Industrial Security: IEC 62443 is easy; 2017 Tolonen; Brig's Handbook of Methods & Research in Product Management and Quality Control; 2018 Stamatis D.H.; Advanced Product Quality Planning: The Road to Success; Boca Raton; 2018		
Acquisition of skills	Product Management /ILV / LV-Nr: PRM.1 / 3.Semester / ECTS: 3 The graduate, the student: * knows the tasks of product management * knows the process and related tools and can apply them * knows the specifics of product management of smart products and solutions		
	Risk Management & Compliance /ILV / LV-Nr: PRM.2 / 2.Semester / ECTS: 5 The graduate / the student: * can consider important criteria such as quality, safety, reliability, availability and resource consumption in product development * knows methods for assessing product quality and product risk		
Course contents	Product Management /ILV / LV-Nr: PRM.1 / 3.Semester / ECTS: 3 * Special features of smart products * New product management approaches * Market research * Product strategy * Purchase decision criteria or acceptance (drivers, obstacles) * Special features of introduction and marketing * Data-based decisions * Life cycle management		
	Risk Management & Compliance /ILV / LV-Nr: PRM.2 / 2.Semester / ECTS: 5 * Product & process life cycle * Risk determination strategies * Planning of safe systems (concepts & strategies) * Planning of secure systems (threat analysis, countermeasures) * Structure & concepts of reliable control systems		
Teaching and learning methods	Product Management /ILV / LV-Nr: PRM.1 / 3.Semester / ECTS: 3 Lecture, group work, presentation and discussion of tasks		
	Risk Management & Compliance /ILV / LV-Nr: PRM.2 / 2.Semester / ECTS: 5 Lecture, group work, presentation and discussion of tasks		
Evaluation Methods Criteria	Product Management /ILV / LV-Nr: PRM.1 / 3.Semester / ECTS: 3 Exam		
	Risk Management & Compliance /ILV / LV-Nr: PRM.2 / 2.Semester / ECTS: 5 Exam		

Module number:	Practice transfer	Scope:	
PXT		**8**	**ECTS**

Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time
Position in the curriculum	2. Semester
	3. Semester
Level	2. Semester: - / 3. Semester: Master
Previous knowledge	2. Semester: none / 3. Semester: none
Blocked	no
Participant group	Bachelor graduates, beginners
Literature recommendation	<u>Study trip /ILV / LV-Nr: PXT.1 / 2.Semester / ECTS: 3</u> Thomas D.C., Peterson M.F.; Cross-Cultural Management: Essential Concepts; Los Angeles; 2017 Reise M.; Lead Markets, Country-Specific Success Factors of the Global Diffusion of Innovations; Berlin; 2014
	<u>Business Project /PT / LV-Nr: PXT.2 / 3.Semester / ECTS: 5</u> Patzak G., Rattay G.; Projekt Management. Leitfaden zum Management von Projekten, Projektportfolios und pro-jektorientierten Unternehmen; Wien; 2017, 7. Auflage Schöneck N.M., Voß W.; Das Forschungsprojekt: Planung, Durchführung und Auswertung einer quantitativen Studie; Wiesbaden; 2013 2. Auflage
Acquisition of skills	<u>Study trip /ILV / LV-Nr: PXT.1 / 2.Semester / ECTS: 3</u> The graduate / the student: * knows the cultural specifics of the respective country in terms of innovation, legal framework and management * knows the specifics of the host country regarding smart products and solutions (technology, acceptance, business models, etc.) * knows and understands the research strategy/research system of the host country regarding smart products and solutions
	<u>Business Project /PT / LV-Nr: PXT.2 / 3.Semester / ECTS: 5</u> The graduate / the student: * can question and define tasks accordingly * can derive a suitable scientific methodology based on the task * can carry out intensive study of literature (state of the art approaches) * can transfer research results to applied problems * can lead projects with relevant content concerning the study * can structure projects/project teams (results, times, resources) * knows the tasks and responsibilities as a project member
Course contents	<u>Study trip /ILV / LV-Nr: PXT.1 / 2.Semester / ECTS: 3</u> * International management in a country-specific context * R and D strategy and systems at country level * Technology and innovation approaches
	<u>Business Project /PT / LV-Nr: PXT.2 / 3.Semester / ECTS: 5</u> * Working in a team and team organization * Deducing a problem * Choosing a suitable methodology and corresponding tools * Planning, implementing and managing projects * Integrative applications of acquired skills and knowledge * Preparing and communicating results * Self-reflection
Teaching and learning methods	<u>Study trip /ILV / LV-Nr: PXT.1 / 2.Semester / ECTS: 3</u> Lecture, group work, presentation and discussion of tasks
	<u>Business Project /PT / LV-Nr: PXT.2 / 3.Semester / ECTS: 5</u> Group work
Evaluation Methods Criteria	<u>Study trip /ILV / LV-Nr: PXT.1 / 2.Semester / ECTS: 3</u> Report
	<u>Business Project /PT / LV-Nr: PXT.2 / 3.Semester / ECTS: 5</u> Project

Module number:	Elective		Scope:	
WPF			**22**	**ECTS**
Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time			
Position in the curriculum	3. Semester			
	4. Semester			
Level	3. Semester: English version available soon / 3. Semester: Master / 3. Semester: second cycle, Master / 4. Semester: Master			
Previous knowledge	3. Semester: English version available soon / 3. Semester: none / 4. Semester: none			
Blocked	no			
Participant group	Bachelor graduates, beginners			
Literature recommendation	Trends in Data Science (elective) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3 Due to the changeability of the content, only a few web sources are listed here as examples, which are currently strongly represented in the area of Data Science Trends: - Medium (2020): Towards Data Science (Ed. 1), online, https://towardsdatascience.com/. - KDNuggets (2020): Knowledge Discovery Nuggets (Ed. 1), online, https://www.kdnuggets.com/. Trends in Smart Products (elective) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3 Huber W.; Industrie 4.0 kompakt – Wie Technologien unsere Wirtschaft und unsere Unternehmen verändern: Transformation und Veränderung des gesamten Unternehmens; Wiesbaden; 2018 Iyer B., Venkatraman V.; "What comes after smart products?", Havard Business Review; 2015 Roth A.; Einführung und Umsetzung von Industrie 4.0: Grundlagen, Vorgehensmodell und Use Cases aus der Praxis; Wiesbaden; 2016 Application-oriented analysis platforms (elective)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4 PRIMARY LITERATURE: - Mishra, A. (2019): Machine Learning in the AWS Cloud: Add Intelligence to Applications with Amazon SageMaker and Amazon Rekognition (Ed. 1), Wiley, Chichester (ISBN: 978-1119556718) - Klinkenberg, R., Hofmann, M. (2016): RapidMiner (Ed. 1), Chapman and Hall, Farnham (ISBN: 978-1482205503) SECONDARY LITERATURE: - Lakshmanan, V. (2017): Data Science on the Google Cloud Platform: Implementing End-to-End Real-Time Data Pipelines: From Ingest to Machine Learning (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1491974537) Internet of Things (elective)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4 Perry L.; Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security; Birmingham; 2018 Sinclair B.; IoT Inc: How Your Company Can Use the Internet of Things to Win in the Outcome Economy; 2017 Thomas O., Nüttgens M., Fellmann M. (Herausgeber); Smart Service Engineering: Konzepte und Anwendungsszenarien für die digitale Transformation; Wiesbaden; 2017 Data Visualization & Visual Analytics (elective) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4 PRIMARY LITERATURE: - Chang, W. (2013): R Graphics Cookbook: Practical Recipes for Visualizing Data (Ed. 1), O'Reilly, Farnham (ISBN: 978-1449316952) - Chen, C.; Härdle, W. K.; Unwin, A. (2008): Handbook of Data Visualization (Ed. 1), Springer, Berlin (ISBN: 978-3-662-50074-3) SECONDARY LITERATURE: - Dale, K. (2016): Data Visualization with Python and Javascript: Scrape, Clean, Explore & Transform Your Data (Ed. 1), O'Reilly, Farnham (ISBN: 978-1491920510) - Murray, S. (2017): Interactive Data Visualization for the Web: An Introduction to Designing with D3 (Ed. 2), O'Reilly, Farnham (ISBN: 978-1491921289) Digital Twin & Simulation (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4 Nath, S. V. (2021). Building Industrial Digital Twins : Design, Develop, and Deploy Digital Twin Solutions for Real-World Industries Using Azure Digital Twins. Zhang, Y. (2024). Digital Twin Architectures, Networks, and Applications (1st ed. 2024). Blaschke, F. (2024). Implementation and Benefits of Digital Twin on Decision Making and Data Quality Management. (1st ed.). Digital Twin Technology. (2023). IntechOpen. Tao, F., Zhang, M., & Nee, A. Y. C. (2019). Digital twin driven smart manufacturing.			
Acquisition of skills	Trends in Data Science (elective) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3			

	The following learning outcomes are developed in the course: - Students are familiar with current thematic trends in the field of data science. - Students are familiar with current technological developments in the field of data science. - Students are familiar with current practical issues in the field of data science.

Acquisition of skills	<u>Trends in Smart Products (elective) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u> The graduate / the student: * understands the concepts of smart applications such as Smart House, Smart City, Smart Production, Connected Vehicles etc. * knows and understands the latest trends in the field of these applications
	<u>Application-oriented analysis platforms (elective)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u> The following learning outcomes are developed in the course: - Students are familiar with different, application-oriented analysis platforms (e.g. KNIME, RapidMiner, Grafana) - Students can compare the analysis platforms they have learned with regard to their suitability for a specific ap-plica-tion. - Students have gained first application experience with the platforms presented.
	<u>Internet of Things (elective)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u> The graduate, the student: * knows basic IOT architectures * knows methods of data generation * knows basics of data transmission * knows options of data storage * knows forms of data visualization * understands challenges of data security
	<u>Data Visualization & Visual Analytics (elective) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4</u> The following learning outcomes are developed in the course: - Students will have basic knowledge of data visualization and visual communication. - Students can develop visualizations independently and use them for communication purposes. - Students can work with different presentation tools and presentation libraries to present data and analysis results in a meaningful way.
	<u>Digital Twin & Simulation (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4</u> The students: * understand the basics of modeling and can apply these * know typical applications and advantages of simulations * know simulation areas and simulation software for smart products and solutions * can create models and simulation processes * can interpret simulation results * can define a smart communicating product * are familiar with the concepts of digital twin, condition monitoring, predictive maintenance
Course contents	<u>Trends in Data Science (elective) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3</u> The contents of this course are not set, but will be adapted to the current prevailing trends. Content examples may include: - New technologies in the field of Big Data Processing - Trends in programming languages in data analysis - New concepts of data processing (e.g. Data Lake) - New questions in the field of data science research - New questions in data science practice
	<u>Trends in Smart Products (elective) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u> * Current best practice approaches and concepts in application areas (e.g. Smart Home, Smart City, Smart Produc-tion, Connected Vehicles, etc.) * Current best practice approaches with regard to development processes and tools * Current research and development activities or research and development results
	<u>Application-oriented analysis platforms (elective)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u> The following content is discussed in the course: - Presentation of different user-oriented analysis platforms (e.g. KNIME, RapidMiner, Grafana) - Presentation of different cloud solutions for data analysis (e.g. Google Cloud, AWS, Azure) - Application of the platforms presented using the example of analysis data sets - Discussion of the different approaches
	<u>Internet of Things (elective)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u>

	Introduction * IoT architecture (e.g. reference models) * Requirements for IOT systems * IOT data transmission protocols * Use of IOT in an industrial context (examples) * Basics of sensor technology * Basics of embedded systems Implementation

Course contents	* Procedure for implementing IOT * Prototypical implementation of IOT * Selection of sensors * Collection, visualization and evaluation of data * Implementation challenges
	Data Visualization & Visual Analytics (elective) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4 The following content is discussed in the course: - Evaluation tools with visual orientation, e.g. BI tools such as MS PowerBI, Tableau, QlikView - Display libraries, e.g. matplotlib. pyplot, gglot2 - Rules of visual communication, e.g. Hichert SUCCESSSS
	Digital Twin & Simulation (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4 Basics and modeling: -Introduction to digital twins, their importance and areas of application -Communication of the theoretical principles and methods of modeling Simulation and software: -Overview of simulation techniques and their typical applications -Getting to know various simulation software and practical exercises Smart products and solutions: -Creating and analyzing models for smart, communicating products -Integration of digital twins into IoT systems and their advantages In-depth concepts and applications: -Introduction to advanced topics such as condition monitoring and predictive maintenance -Discussion about the role of digital twins in future technology development. Practical project: -Planning and implementing your own digital twin project to apply what you have learned
Teaching and learning methods	**Trends in Data Science (elective) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3** The following methods are used: - Lecture with discussion - Interactive workshop
	Trends in Smart Products (elective) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3 Lecture, group work, presentation and discussion of tasks
	Application-oriented analysis platforms (elective)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4 The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop
	Internet of Things (elective)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4 Lecture, individual work with software, group work, presentation and discussion of tasks
	Data Visualization & Visual Analytics (elective) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4 The following methods are used: - Lecture with discussion - Interactive workshop - Case studies
	Digital Twin & Simulation (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4 Lecture, group work, presentation and discussion of tasks
Evaluation Methods Criteria	**Trends in Data Science (elective) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3** Seminar thesis
	Trends in Smart Products (elective) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3 Seminar thesis
	Application-oriented analysis platforms (elective)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4 Seminar thesis or written exam
	Internet of Things (elective)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4 written exam

	Data Visualization & Visual Analytics (elective) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4
	seminar thesis or written exam

Evaluation Methods Criteria	Digital Twin & Simulation (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4
	Project Work and presentation

Module number:	Master´s Thesis	Scope:	
MA		26	ECTS

Degree program	University of Applied Sciences Master's Program Smart Products & AI-driven Development full-time
Position in the curriculum	3. Semester
	4. Semester
Level	3. Semester: Master / 4. Semester: second cycle, Master
Previous knowledge	3. Semester: English version available soon / 4. Semester: according to admission requirements / 4. Semester: none
Blocked	no
Participant group	Bachelor graduates, beginners
Literature recommendation	Research Methods /SE / LV-Nr: MA.1 / 3.Semester / ECTS: 2 Schütz M., Röbken H.; Bachelor- und Masterarbeiten verfassen: Abschlussarbeiten in Organisationen; Springer Gabler; 2020; 2nd edition Theisen M. R.; Wissenschaftliches Arbeiten: Erfolgreich bei Bachelor- und Masterarbeit; Vahlen; 2017; 17th edition
	Master Thesis Colloquium /SE / LV-Nr: MA.2 / 4.Semester / ECTS: 2 Atteslander, P.; Methoden der empirischen Sozialforschung (13. A.). Berlin: Erich Schmidt Verlag; 2010 Bänsch, A.; Wissenschaftliches Arbeiten (11. A.). Berlin: De Gruyter Oldenbourg; 2013 Mayring, P.; Die Praxis der Qualitativen Inhaltsanalyse (2. A.). Weinheim, Basel: Beltz Verlag; 2008 Theisen, M. R.; Wissenschaftliches Arbeiten: Technik - Methodik - Form (15. A.). Munich: Vahlen; 2011
	Master thesis /UE / LV-Nr: MA.3 / 4.Semester / ECTS: 22 Atteslander, P.; Methoden der empirischen Sozialforschung (13. A.). Berlin: Erich Schmidt Verlag; 2010 Bänsch, A.; Wissenschaftliches Arbeiten (11. A.). Berlin: De Gruyter Oldenbourg; 2013 Mayring, P.; Die Praxis der Qualitativen Inhaltsanalyse (2. A.). Weinheim, Basel: Beltz Verlag; 2008 Theisen, M. R.; Wissenschaftliches Arbeiten: Technik - Methodik - Form (15. A.). Munich: Vahlen; 2011
Acquisition of skills	Research Methods /SE / LV-Nr: MA.1 / 3.Semester / ECTS: 2 The graduate / the student: * knows scientific methods * can formulate research questions and write an exposé on a specialist topic * can work on a specialist topic using scientific methods * can research literature independently * can write a scientific poster on a specialist topic
	Master Thesis Colloquium /SE / LV-Nr: MA.2 / 4.Semester / ECTS: 2 The graduate / the student: • knows how scientific reviews are conducted • knows how to present results to a scientific community • can critically question scientific findings
	Master thesis /UE / LV-Nr: MA.3 / 4.Semester / ECTS: 22 The graduate / the student: * can independently write a scientific paper on a specialist topic in the field of product development, product management, smart products
Course contents	Research Methods /SE / LV-Nr: MA.1 / 3.Semester / ECTS: 2 * Advancing the methods and approaches of scientific work * Research design for scientific questions * Qualitative and quantitative research methods * Use of methods and tools * State of the art literature research and use of citation tools e.g. Citavi * Preparation of the exposé for the Master thesis * Notes on the formal design of the Master thesis
	Master Thesis Colloquium /SE / LV-Nr: MA.2 / 4.Semester / ECTS: 2 • Support of the students during the preparation of the Master thesis • Presentation and discussion of the question/ hypothesis, structure of the Master thesis, scientific methodology and formal design of the Master thesis
	Master thesis /UE / LV-Nr: MA.3 / 4.Semester / ECTS: 22

	* Supervising the students during the preparation of the Master thesis * Presentation and discussion of the question/hypothesis, structure of the Master thesis, scientific methodology and formal design of the Master thesis * Review of the analysis part and critical reflection for evaluation * Structure of the thesis, appropriate division, clear result structure and conclusion * Short overview of the Master's examination and its requirements

Teaching and learning methods	Research Methods /SE / LV-Nr: MA.1 / 3.Semester / ECTS: 2 Lecture, individual work, presentation and discussion of tasks
	Master Thesis Colloquium /SE / LV-Nr: MA.2 / 4.Semester / ECTS: 2 Lecture, presentation and discussion of tasks
	Master thesis /UE / LV-Nr: MA.3 / 4.Semester / ECTS: 22 Master thesis
Evaluation Methods Criteria	Research Methods /SE / LV-Nr: MA.1 / 3.Semester / ECTS: 2 Student research project
	Master Thesis Colloquium /SE / LV-Nr: MA.2 / 4.Semester / ECTS: 2 Presentation
	Master thesis /UE / LV-Nr: MA.3 / 4.Semester / ECTS: 22 Master thesis

2.4 Internship

Internship (semester information, duration in weeks per semester)	No	No

2.5 Semester Abroad

Obligatory semester abroad (semester specification)	No	No

3 ADMISSION REQUIREMENTS

The general admission requirements are regulated by Section 4 FHG (Universities of Applied Sciences Act), as amended. Accordingly, the subject-specific admission requirement for a master's degree program at a university of applied sciences is a completed subject-relevant bachelor's degree program at a university of applied sciences or the completion of an equivalent degree program at a recognized domestic or international post-secondary educational institution.

1. Bachelor's degree programs (or equivalent post-secondary educational qualifications) eligible as a basis for admission to this degree program should cover the core subject area of engineering sciences (based on ISCED 2013, Fields of Education and Training 06/071/072), with a minimum of 30 ECTS credits allocated to that area. In addition, such educational qualifications should include content from the fields of economics and business administration (e.g., accounting, marketing, business administration and management) amounting to a minimum of 10 ECTS credits.

2. The degree programs of the University of Applied Sciences Kufstein Tirol provide for continuity between the bachelor's and master's levels in line with the Bologna Process. After successful completion of a bachelor's degree program, graduates should have varied opportunities to pursue a master's degree program both within and outside the University. In line with the above, graduates of the following degree programs at the University of Applied Sciences Kufstein Tirol (regardless of the organizational form) shall be deemed eligible for the present master's degree program:

    • Coding & Digital Design
    • Energy & Sustainability Management
    • Facility & Real Estate Management
    • Industrial Engineering & Management

3. The language of instruction is exclusively English. Therefore, proof of English language proficiency at a level of at least B2 (CEFR) is required.

4. The Director of Studies of the master's degree program in Smart Products & AI-driven Development is responsible for assessing applicants' eligibility in line with the above admission criteria.