Study regulations of the
Master study program

Smart Products & Solutions

leading to the award of the academic title

Master of Science in Engineering (MSc)

as an appendix to the statutes of the FH Kufstein Tirol

Organizational form: part-time
Duration: 6 semesters
Number of ECTS: 120 ECTS
Number of places per academic year: 30

Version 1
Accredited by AQ Austria on 28.06.2017 by decision of 05.07.2017
Content based on accreditation application

Content

With the amendment to the University Act 2020, the so-called "University of Applied Sciences Studies Act (FHStG)" has been renamed "University of Applied Sciences Act (FHG)". Accordingly, a necessary editorial adjustment was made in this document on January 13th, 2021 and the name FHStG was replaced by FHG.

1 JOB PROFILES

1.1 Fields of employment

Graduates of the study program Smart Products & Solutions have a broad technical and economics skill-set, meaning that they are able to work in all fields related to smart products and the solutions built on these.

Workers and managers are particularly in demand in the following areas:

- Machinery and plant engineering
- Equipment manufacturing
- Vehicle manufacturing
- Energy sector
- Logistics, transport
- Consulting

It is difficult to allocate these activities to specific branches, because through technological change smart products and their related solutions are relevant for all companies these days. This means that graduates can work in a wide range of branches for companies of all sizes. Large, medium and small companies all need qualified workers with a technical and/or engineering background. It should also be highlighted that the curriculum has been designed in such a way that graduates are able to found their own company upon completion of the study program. Outside-the-box thinking fosters innovative and unconventional ideas in particular. This theoretical knowledge, combined with the necessary practical skills, makes it plausible that graduates of this study program will be able to go on to create their own companies.
The study program aims to give students a broad general education. As such, the fields in which they may go on to work are diverse. These fields are characterized in particular by the following elements:

1. Technical tasks at the interface between technology and economics.
2. Management tasks in which graduates can apply their skills This can be either in a freelance capacity or within a company structure, at the level of middle or senior management.

After an initial induction phase, graduates of this study program are able to take leadership positions. Several examples are listed below.

Technical project management
Technical project management can apply to leadership positions in all technical areas. Project managers have the skills to take important decisions in their respective area of responsibility.
These include:

- Acting as an interface between the client and the developer
- Writing specification sheets and technical documentation
- Contract management as well as chance and risk management
- Project coordination & communication
- Project-specific controlling and reporting
- Coordination and leadership of an internal project team
- Presenting projects to superiors and clients

Development
Developing new services and products requires not only a
deep understanding of the market and the customer's requirements but also the necessary technical and business skills. Developers and their decisions have a major influence on the success of specific products and of the company overall.
These include:

- Following and evaluating trends
- Following and evaluating technologies
- Translating market/customer needs into technical requirements
- Writing specification sheets and technical documentation.
- Selecting a suitable system architecture
- Selecting suitable technologies/components
- Simulation and prototyping
- Feasibility studies
- Presenting concepts and solutions
- Optimizing concepts

Innovation and technology management
The core area is understanding and evaluating technology, architecture and business models in the context of the company, e.g. company and product strategy, positioning, market and competition dynamics, etc.
These include:

- Following and evaluating trends
- Following and evaluating and developing technologies
- Finding ideas and developing concepts
- Development from early prototypes to safeguarding
- Advising others within the company
- Creating analyses, specification sheets/concepts
- Studies as well as status quo and field analysis
- Presenting concepts and solutions

Product management
Product management is a diverse field and requires not only understanding of the market and the client but also an understanding of the underlying issues. This makes it possible to match what is technically possible with what the client actually wants.
These include:

- Following and evaluating market trends
- Following and evaluating client trends
- Defining product requirements/additions
- Writing specification sheets and technical documentation
- Monitoring development and ensuring that the product has the required properties
- Introducing the product onto the market

Manager digital transformation
Managers working in the field of digital transformation have a wide range of tasks. As this is a new field, many of these tasks are still to be precisely defined. In general it can be said that those working in this field play a transformative role, meaning that they are responsible for the digital aspects of business. At the same time they are also responsible for further developing the company itself when it comes to matching the demands of digitalization.
These include:

- Developing a digitalization strategy
- Deriving organizational structures and processes
- Monitoring and supporting implementation at different levels
- Initiating and supporting process changes
- Monitoring and supporting organizational development
- Providing input for digital innovations

Technical consulting
Technical consultants provide advice for clients such as industrial and manufacturing companies on technical innovations, areas of application and the advantages of certain technical solutions. They develop technical concepts for their clients and monitor the implementation of these concepts.
These include:

- Consulting
- Acquisition and implementation of consulting projects
- Tasks related to technical analysis and realization
- Drawing up offers
- Creating product strategies and feasibility studies
- Creating concepts, introducing requirements which have already been drawn up, technical documentation
- Requirement analyses
- Technical specification
- Technical support in different areas of the value chain

Company foundation
These include:

- Creating/developing products and business models incl. business plans
- Acquiring customers and partners
- Implementation and developing business

Research into smart products and solutions
These include:

- Initiating, leading and coordinating research projects
- Working on research projects
- Explorative application and (further) development of new technologies

1.2 Qualification profile

The qualification aims and learning outcomes of the Master study program Smart Products & Solutions meet both the necessary technical and the professional requirements of this field as well as the ISCED 0788 (International Standard Classification of Education[7]). Graduates are able to work in the fields outlined above. Upon completion of the Master study program they will have achieved the following learning outcomes, which qualify them for positions in companies of different branches and sizes.

Graduates are able to work in the positions, tasks and areas outlined above. The curriculum aims to give them the skills to plan and develop concepts for smart products and solutions as well as to monitor their implementation and introduction to the market from a technical and business perspective.

For this they require technical knowledge which is specially adapted to the needs of smart products and takes into account the specific nature of these products. This includes sensor/actuator technologies, embedded systems, transmission technologies, platforms and knowledge of how to create value from these.

Last but not least, graduates acquire management skills in developing and introducing processes for smart solutions and their accompanying services incl. their implementation. Students are capable of professional project management and are able to draw on a collection of methods which enables them to support the special characteristics of developing smart products and solutions with the necessary changes.

Finally, students at the end of their studies have the detailed knowledge they need to develop smart products and solutions and know about the related challenges. The study program aims not only to give students the theoretical knowledge they need but also to promote their general transfer, analytical and application skills.

Graduates of the Master study program Smart Products & Solutions have the following general skills. Graduates:

- Understand the aspects of the technical, business, social and legal environment.
- Are able to used joined-up thinking to come up with innovative and effective solutions (holistic thinking) for tasks in a wide range of business and technical fields.
- Can familiarize themselves quickly, methodically and systematically with new and unknown topics.
- Work in an effective way with others and communicate in a logical and convincing manner.
- Take on leadership roles in interdisciplinary and intercultural teams and organizations.
- Can act in a flexible way in order to react to changing demands.

The following qualification aims are particularly addressed as part of this study program:

[7] http://www.uis.unesco.org/Education/Pages/international-standard-classification-of-education.aspx
[8] Brettel, et al.: Qualifikationsrahmen Industrial Engineering & Management, FFBT Industrial Engineering & Management e.V. 2012

Product creation with focus on definition and concept phase
Graduates have the knowledge, understanding and practical skills to determine the demands of smart products and solutions from a technical and business perspective during the definition phase, to develop alternative concepts and to evaluate these as necessary. Furthermore, they are able to define an appropriate process and use appropriate methods.

- Defining the technical and business-related demands for a smart product/solution.
- Developing a concept taking into account the framework conditions at technical and business level.
- Identifying and selecting technologies/components/platforms.
- Developing business models and creating a business plan.
- Managing product development projects.
- Managing development and introductory processes.
- Supporting the marketing of smart products and solutions.
- Convincing presentation skills.
- Managing smart products and solutions throughout their life cycle.

Data generation and use
Graduates have the skills they need to process data in an appropriate way according to the demands of the respective situation. This includes defining which data are required, processing these data, analyzing and interpreting the results and using these as required:

- Defining the goals
- Deriving the necessary methods and approach
- Creating models
- Developing the concept, evaluating and selecting systems
- Implementation of the concept (prototypical)

Digital transformation in companies
Graduates have the skills in order to analyze and describe the necessary steps and requirements of increasing digitalization for companies at different levels. This change begins at the staff level. Members of staff must be managed according to the needs of the new digital age, taking into consideration the special characteristics of international teams and projects with their processes and structures.

- Know the need for change and obstacles when it comes to implementing digitalization.
- Are able to put assemble project teams.
- Leadership in the digital age.
- Can manage changes in companies.

Cross-cutting skills
As well as the specific skills taught as part of this study program, students acquire social, methodological and personal skills including theory-practice transfer skills. Graduates are able to:

- Apply theoretical knowledge to practical tasks.
- Think in an integrated and interdisciplinary way in line with practice-theory reflection.
- Present/communicate results in a structured and appropriate way and to adhere to the formal and content-related requirements of academic writing, in particular when it comes to producing a Master thesis.

Master study programs equate to level 7 of the qualification framework for the European Higher Education Area.

While it is impossible to match graduates' skills precisely to the following categories, a general allocation of skills to fields can be made.

- The Master provides students with highly specialized knowledge reflecting the latest research results and at the same time encourages them to carry out a critical analysis of issues in the areas which are addressed (*product creation, data generation, data use, etc.)*
- The Master teaches students problem-solving skills in the field of innovation in order to develop new knowledge and to integrate know-how from different fields using their general knowledge of business and engineering (*digital transformation, etc.*)
- Upon graduation, students are able to apply the skills and knowledge they have learned in changing and/or new work contexts using situation-specific approaches and, on the other hand, to assume a leadership role in this process (*cross-cutting skills, etc.*)

2 CURRICULUM

2.1 Curriculum details

Curriculum Details (Columns "FT" or "PT" or "FT"+"PT" to be completed depending on how study program is organised)			
	FT	**PT**	**Comments**
First academic year (YYYY/YY+1)		2017/18	
Normal duration of studies (number of semesters)		4	
Total course hours (mandatory) (total of all semesters)		60	
Teaching weeks per semester		15	
Total courses (mandatory) (total of all semesters)		900	
Total ECTS (mandatory) (total of all semesters)		120	
Start of winter semester (Date or calendar week)		Week 39	
End of winter semester (Date or calendar week)		Week 7	
Start of summer semester (Date or calendar week)		Week 9	
End of summer semester (Date or calendar week)		Week 28	
Weeks in winter semester		17	
Weeks in summer semester		17	
Mandatory semester abroad (semester)		No	There is no mandatory semester abroad. An international study trip is planned in the 3rd semester with block courses held at a partner university.
Teaching language (to be indicated)		German	The proportion of English-language courses is 28%
Internship (Semester, duration in weeks per semester)		No	
Resulting from combination of study programs or separation from separate study program (study program code; only required in case of combination or separation)			

2.2 Semester-by-semester model of the curriculum

1st semester								
Code	Course name ("E" = English-language course)	Type	TU	No. of groups	TUO	CHO	Module	ECTS
WMF.1	Digital Transformation (E)	ILV	1.0	1	1.0	15.0	WMF	1.5
DVA.1	Introduction to Programing	VO	1.5	1	1.5	22.5	DVA	2.0
DVA.2	Introduction to Programing	UE	2.0	2	4.0	60.0	DVA	4.0
DVA.3	Embedded Systems	VO	1.5	1	1.5	22.5	DVA	2.0
DVA.4	Embedded Systems	UE	2.0	2	4.0	60.0	DVA	4.0
DGU.1	Sensor Systems	VO	1.5	1	1.5	22.5	DGU	2.0
DGU.2	Sensor Systems	UE	2.0	2	4.0	60.0	DGU	4.0
PDE.1	Mechatronic Systems & Actuators	VO	1.5	1	1.5	22.5	PDE	2.0
PDE.2	Mechatronic Systems & Actuators	UE	2.0	2	4.0	60.0	PDE	4.0
PDE.3	Systems Engineering (E)	ILV	2.0	1	2.0	30.0	PDE	3.0
WMF.2	Project Management & Team Building (E)	ILV	1.0	1	1.0	15.0	WMF	1.5
Total:			18		26	390		30
Course = total teaching units per week x 15 teaching			270					

2nd semester								
Code	**Course name ("E" = English-language course)**	Type	TU	No. of groups	TUO	CHO	Module	ECTS
DGU.3	Data Transmission	VO	1.5	1	1.5	22.5	DGU	2.0
DGU.4	Data Transmission	UE	2.0	2	4.0	60.0	DGU	4.0
DVA.5	Data Science	VO	1.5	1	1.5	22.5	DVA	1.5
DVA.6	Data Science	UE	2.0	2	4.0	60.0	DVA	4.0
DVA.7	Model Based Analytics	ILV	1.5	1	1.5	22.5	DVA	2.5
PDE.4	Design Thinking (E)	UE	1.0	2	2.0	30.0	PDE	2.0
PDE.5	Interaction Design & Product Design	ILV	3.5	1	3.5	52.5	PDE	6.0
PDE.6	Concept Development (E)	UE	2.0	2	4.0	60.0	PDE	4.0
PDE.7	Simulation	UE	2.0	2	4.0	60.0	PDE	4.0
Total:			17		26	390		30
Course = total teaching units per week x 15 teaching			255					

3rd semester								
Code	**Course name ("E" = English-language course)**	Type	TU	No. of groups	TUO	CHO	Module	ECTS
WMF.3	Strategy, Business Model/Process Model and Business Plan	ILV	2.0	1	2.0	30.0	WMF	3.0
WMF.4	Strategy, Business Model/Process Model and Business Plan	UE	2.0	2	4.0	60.0	WMF	4.0
WMF.5	Product Management	ILV	1.0	1	1.0	15.0	WMF	2.0
PDE.8	Advanced Engineering (E)	ILV	2.0	1	2.0	30.0	PDE	3.0
DVA.8	Business Technology Platforms	ILV	2.0	1	2.0	30.0	DVA	3.0
PDE.9	Smart Applications & Trends	ILV	2.0	1	2.0	30.0	PDE	3.0
MFE.1	International Study Trip (E)	ILV	2.0	1	2.0	30.0	MFE	3.0
MFE.2	Practical/Research Project	PT	2.0	4	8.0	120.0	MFE	4.0
MFE.3	Academic Writing Skills	SE	1.0	1	1.0	15.0	MFE	2.0
ELE.1	Elective I (FH-wide optional subject) (E)	ILV	2.0	1	2.0	30.0	ELE	3.0
Total:			18		26	390		30
Course = total teaching units per week x 15 teaching weeks			270					

4th semester								
Code	Course name ("E" = English-language course)	Type	TU	No. of groups	TUO	CHO	Module	ECTS
WMF.6	Data Protection and Ethics (E)	ILV	1.0	1	1.0	15.0	WMF	1.5
WMF.7	Change Management	ILV	1.0	1	1.0	15.0	WMF	2.0
WMF.8	Leadership (E)	ILV	1.0	1	1.0	15.0	WMF	1.5
WMF.9	Value Selling & Communication	ILV	1.0	1	1.0	15.0	WMF	2.0
ELE.2	Elective II (FH-wide optional subject) (E)	SE	2.0	1	2.0	30.0	ELE	3.0
MFE.4	Master Thesis	MA	0.6	30	18.0	270.0	MFE	18.0*
MFE.5	Master Thesis Colloquium	SE	1.0	2	2.0	30.0	MFE	2.0
Total:			7.6		26	390		30
Course = total teaching units per week x 15 teaching weeks			114					
Total of all semester			60		104	1,560		120
Total of all semesters			909					

* The 18 ECTS for the Master Thesis are divided into 16 ECTS for the Master thesis itself and 2 ECTS for the final oral examination in front of an examination board

2.3 Module descriptions

Module number	**Module title**	**Number of ECTS**
PDE	**Product Creation**	**31 ECTS**
Study program	Smart Products & Solutions	
Position in curriculum	1st-3rd semester	
Categorization	Product development with focus on definition and concept phase	
Level	Second cycle, Master	
Previous knowledge	According to admission criteria	
Block course	No	
Participating students	Bachelor graduates	
Contributes to following modules	Connection to modules DGU, DVA, MFE, WMF	
Recommended reading	Mechatronic Systems & Actuators • Czichos (2008): Mechatonik: Grundlagen und Anwendungen technischer Systeme, 2. Aufl., Vieweg+Teubner • Heimann, Albert, Ortner, Rissing (2015): Mechatronik: Komponenten – Methoden - Beispiele, 4. Aufl., Carl Hanser • Madou (2002): Fundamentals of Microfabrication: The Science of Miniaturization, CRC Press • Schwesinger, Dehne, Adler (2008): Lehrbuch Mikrosystemtechnik: Anwendungen, Grundlagen, Materialien und Herstellung von Mikrosystemen, De Gruyter Oldenbourg Systems Engineering • Dori (2016): Model-Based Systems Engineering with OPM and SysML, Springer Verlag • Eigner, Roubanov (2014): Modellbasierte virtuelle Produktentwicklung, Springer Vieweg • INCOSE (2015): INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, 4th ed., John Wiley & Sons • Jenney, et al. (2011): Modern Methods of Systems Engineering: With an Introduction to Pattern and Model Based Methods, CreateSpace Independent Publishing Platform • Kossiakoff, Sweet, Seymour, Biemer (2011): Systems Engineering - Principles and Practice, Wiley-Interscience Design Thinking • Brown (2009): Change by Design – How Design Thinking Transforms Organizations and Inspires Innovation, HarperBusiness • Geracie, Eppinger (2013): The Guide to the Product Management and Marketing Body of Knowledge, 1st ed., Product Management (E) Institutes • Liedtka, Ogilvie (2011): Designing for Growth: A Design Thinking Tool Kit for Managers , Columbia University Press • Osterwalder, Pigneur (2014): Value Proposition Design: How to Create Products and Services Customers Want, 1st ed., John Wiley & Sons Interaction Design & Product Design • Follett (2016): Designing for Emerging Technologies: UX for Genomics, Robotics and the Internet of Things, O´Reilly and Associates • Kalbach (2016): Mapping User Experiences: A Complete Guide to Creating Value through Journeys, Blueprints and Diagrams, O'Reilly Media • King, Chang (2016): Understanding Industrial Design: Principles for UX and Interaction Design, O'Reilly Media • Rowland, et al. (2015): Designing Connected Products: UX for the Consumer Internet of Things, O'Reilly Media • Steane (2014): The Principles and Processes of Interactive Design (Required Reading Range), Bloomsbury Academic • Tidwell (2011): Designing Interfaces, O'Reilly and Associates • Wood (2014): Interface Design: An Introduction to Visual Communication in UI Design (Basics), Bloomsbury Academic	

	Concept Development • Buyya, Dastjerdi (2016): Internet of Things: Principles and Paradigms, Morgan Kaufmann • Slama, et al. (2015): Enterprise IoT: Strategies and Best Practices for Connected Products and Services, O'Reilly Media Simulation • Glöckler (2014): Simulation mechatronischer Systeme: Grundlagen und technische Anwendung, Springer Vieweg • Nollau (2009): Modellierung und Simulation technischer Systeme: Eine praxisnahe Einführung, Springer Berlin Heidelberg Advanced Engineering • Buyya, Dastjerdi (2016): Internet of Things: Principles and Paradigms, Morgan Kaufmann • Russell, Duren (2016): Practical Internet of Things Security, Packt Publishing Smart Applications & Trends • Biedermann (2015): Smart Maintenance: Intelligente, lernorientierte Instandhaltung, 29. Instandhaltungsforum (Praxiswissen für Ingenieure - Instandhaltung), TÜV Media GmbH TÜV Rheinland Group • Huber (2016): Industrie 4.0 in der Automobilproduktion: Ein Praxisbuch, Springer Vieweg • Iyer, Venkatraman (2015) "What comes after smart products?", Havard Business Review • Jaekel (2015): Smart City wird Realität: Wegweiser für neue Urbanitäten in der Digitalmoderne, Springer Vieweg • Manzei, Schleupner, Heinze (2015): Industrie 4.0 im internationalen Kontext: Kernkonzepte, Ergebnisse, Trends, VDE VERLAG GmbH • Roth (2016): Einführung und Umsetzung von Industrie 4.0: Grundlagen, Vorgehensmodell und Use Cases aus der Praxis, Springer Gabler • Watzenig, Horn (2016): Automated Driving: Safer and More Efficient Future Driving, Springer
	Specialist journals • IoT Evolution, Technology Marketing Corporation • IoT Magazine, World Media Online • DIGITAL ENGINEERING, WIN-Verlag • M2M Magazin, World Media Online
Acquisition of skills	Mechatronic Systems – Actuators (VO) Students: • understand how mechatronic systems are made and different approaches to these systems • understand the principles and functioning of regulation and control • understand the fundamentals of different types of actuators and are able to select actuators and control them Mechatronic Systems – Actuators (UE) Students: • can interpret a mechatronic system • know different types of actuators, their function and characteristics and are able to select and use these according to the respective situation • are able to develop and interpret a regulation and control system Systems Engineering Students: • know domain-specific development approaches (mechanical engineering, electrical engineering, IT) • know the approach, process and tools of systems engineering • are able to model and analyze systems • can monitor and support systems engineering projects Design Thinking Students: • know the framework conditions when it comes to using design thinking • are able to solve problems using a structured and impartial process

	• know the appropriate tools for the individual phases of the design thinking process and are able to use these tools Interaction Design & Product Design: Students: • are able to explain design guidelines and contexts for interaction design and product design • can develop and evaluate concepts based on requirements Concept Development: Students: • are able to derive requirements from certain aims and goals • building on that, are able to develop alternative concepts and solutions • can evaluate these according to a catalogue of criteria as well as take a decision and evaluate that decision • know prototyping approaches and are able to use these in a targeted manner Simulation Students: • know relevant development/simulation environments related to smart products and solutions • know the uses and advantages of simulation Advanced Engineering Students are able to take the following issues into consideration when developing a concept: • Security and safety • Reliability and availability • Energy consumption Smart Applications & Trends Students: • understand the concepts of smart applications such as smart house, smart city, smart production, connected vehicles, etc. • know and understand the latest trends related to these applications
Course title	**Mechatronic Systems & Actuators**
Number of ECTS	2 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Lecture
Examination methods	Written examination
Course content	• Introduction to mechatronics. • Technical systems (function, structure, properties) • Mechatronic systems (modelling, time/image area, state space) • Construction and functioning of actuators (e.g. electromechanical, piezo-electric, fluid-mechanical, thermo-mechanical actuators) • Microactuators and smart actuators • Controlling actuators • Properties of actuators (e.g. behavior, reliability, energy consumption, etc.) • Principles, construction and properties of regulation and controlling.
Course title	**Mechatronic Systems & Actuators**
Number of ECTS	4 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Practical course accompanying theoretical lecture • Practical application of knowledge taught in lecture

Course title	**Systems Engineering (E)**
Number of ECTS	3 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Integrated course
Examination methods	Written examination and assignments
Course content	• Definition of systems • Domain-specific approach models (mechanical engineering, electronic engineering, software) and systems engineering • Process, principles and tools in systems engineering • Model perspectives in systems engineering • Creating and analyzing models • Case studies of projects
Course title	**Design Thinking (E)**
Number of ECTS	2 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Practical course
Examination methods	Assignments
Course content	• Introduction and development • Fundamental principles of the approach • Process logic and phases • Tool-set of creative working principles • Case studies for design thinking projects • Reflection of design thinking process / design thinking projects
Course title	**Interaction Design & Product Design**
Number of ECTS	6 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Integrated course
Examination methods	Written examination and assignments
Course content	• Definition/differentiation: interaction design vs. product design • Identification of position in the product creation process • Process, approaches/principles and tools for interaction design • Process, approaches/principles and tools for product design • Evaluation criteria and evaluation of own or existing concepts
Course title	**Concept Development (E)**
Number of ECTS	4 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Concept elements for smart products and designs • Approaches/tools for their presentation/documentation (functional and technical design) • Prototyping • Practical application using tasks and a project

Course title	**Simulation**
Number of ECTS	4 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Applications and advantages of simulations • Simulation areas and simulation software for smart products and solutions • Creating models and simulations • Interpreting the results of simulations
Course title	**Advanced Engineering (E)**
Number of ECTS	3 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Integrated course
Examination methods	Written examination and assignment
Course content	Challenges, references and approaches for • security & safety • Reliability and availability • Energy consumption
Course title	**Smart Applications & Trends**
Number of ECTS	3 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Integrated course
Examination methods	Written examination
Course content	• Current best-practice approaches and concepts in areas of application (e.g. smart home, smart city, smart production, connected vehicles, etc.) • Current best-practice approaches for development process and tools • Current research and development activities and results

Data Generation and Transmission

Module number	**Module title**	**Number of ECTS**
DGU	**Data Generation and Transmission**	**12 ECTS**
Study program	Smart Products & Solutions	
Position in curriculum	1st-2nd semester	
Categorization	Data generation and use	
Level	Second cycle, Master	
Previous knowledge	According to admission criteria	

Block course	No
Participating students	Bachelor graduates
Contributes to following modules	Connection to the modules PDE, DVA, MFE, WMF
Recommended reading	<u>Sensor Systems</u> • Czichos (2008): Mechatonik: Grundlagen und Anwendungen technischer Systeme, Vieweg+Teubner Verlag • Heinrich (2014): Grundlagen Automatisierung: Sensorik, Regelung, Steuerung, Springer Fachmedien Wiesbaden • Schenk (2015): Produktion und Logistik mit Zukunft (VDI-Buch), Springer Vieweg • Tränkler, Reindl (2015): Sensortechnik: Handbuch für Praxis und Wissenschaft, Springer Vieweg • Winner, et al. (2015): Handbuch Fahrerassistenzsysteme: Grundlagen, Komponenten und Systeme für aktive Sicherheit und Komfort (ATZ/MTZ Fachbuch), 3. Aufl., Springer Vieweg <u>Data Transmission</u> • Baun (2012): Computernetze kompakt, Springer Vieweg • Badach, Hoffmann (2015): Technik der IP-Netze: Internet-Kommunikation in Theorie und Einsatz, Carl Hanser • Gessler, Krause (2015): Wireless-Netzwerke für den Nahbereich: Eingebettete Funksysteme: Vergleich von standardisierten und proprietären Verfahren, Springer Vieweg • Kurose, Ross (2014): Computernetzwerke: Der Top-Down-Ansatz, 6. Aufl., Pearson Studium • Tanenbaum (2012): Computernetzwerke, 5. Aufl., Pearson Studium • Peterson, Davie (2007): Computernetze - Eine systemorientierte Einführung, 4. Auflage, dpunkt.verlag • Sauter (2015): Grundkurs Mobile Kommunikationssysteme: LTE-Advanced, UMTS, HSPA, GSM, GPRS, Wireless LAN und Bluetooth, Springer Vieweg • Scherff (2007): Grundkurs Computernetze: Eine kompakte Einführung in die Rechnerkommunikation – Anschaulich, verständlich, praxisnah, Vieweg+Teubner • Schreiner(2016): Computernetzwerke: Von den Grundlagen zur Funktion und Anwendung, Carl Hanser Wellenreuther, Zastrow (2015): Automatisieren mit SPS - Theorie und Praxis: Programmieren mit STEP 7 und CoDeSys, Entwurfsverfahren, Bausteinbibliotheken Beispiele für Steuerungen, ... PROFINET, Ethernet-TCP/IP, OPC , WLAN, Springer Vieweg
	<u>Specialist journals</u> Forschung, das Magazin der deutschen Forschungsgesellschaft, DFG ATZelektronik – Springer Fachmedien E & i Elektronik & Informationstechnik Springer Vienna

Acquisition of skills	<u>Sensor Systems</u> <u>(VO)</u> Students: • know the process chain between sensor systems and actuators • are able to characterize the broad field of sensors • are able to explain the advantages and disadvantages of different sensors for a certain application and are able to select appropriate sensors for a particular application <u>Sensor Systems</u> <u>(UE)</u> Students: • acquire the ability to describe how sensors are made, to interpret data sheets and to carry out measurements • are able to interpret measurement results and know their format in order to optimize further data processing <u>Data Transmission (VO)</u> Students: • understand the properties of different transmission technologies • know relevant evaluation criteria (latency, availability, data transfer rate, etc.) and are able to specify demands, derive approaches and evaluate these • understand architectures, processes and protocols <u>Data Transmission (UE)</u> Students: • are able to define demands placed on data transmission • are able to evaluate data transmission technologies and protocols based on these demands • know how certain transmission technologies are constructed
Course title	**Sensor Systems**
Number of ECTS	2 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Lecture
Examination methods	Written examination
Course content	• Definition/classification of sensors • Construction and function of a measurement chain • Areas of application and functioning principles of sensors • Fundamentals of microsensors • Properties of sensors (static and dynamic behavior, reliability, etc.) • Measurement errors and sources of error • Calibration • Signal transfer/processing
Course title	**Sensor Systems**
Number of ECTS	4 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Practical course
Examination methods	Final report

Course content	• Fundamental concepts of measurement techniques • Use of sensors for different areas (e.g. temperature, weight, pressure, acceleration, position, etc.) • Analysis and evaluation of functioning principles and properties of sensors • Construction and properties of data transmission and data processing in a measurement chain • Analyzing, interpreting and storing measurements
Course title	**Data Transmission**
Number of ECTS	2 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Lecture
Examination methods	Written examination
Course content	• Fundamentals of data transmission • Technologies and use of modern networks • OSI, hybrid and TCP/IP reference model • Direct connection networks: Hardware components and connecting elements • Wireless networks: Transmission technologies and their properties (e.g. WLAN, Bluetooth, RFID), hardware components • Sensor networks and approaches (e.g. MANET, WMN) • Cloud computing - transmission, use and connection • End-to-end protocols: UDP, TCP • Selected protocols from the application layer (e.g. FTP, HTTP, HTTPS, SMTP, MQTT) • Security concepts and access methods • Release updates for networks
Course title	**Data Transmission**
Number of ECTS	4 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Selection of transmission technologies and protocols • Construction and application of conducted approaches • Construction and application of conducted approaches with a focus on sensors/actuators • Construction and application of sensor networks

Data Processing

Module number	**Module title**	**Number of ECTS**
DVA	**Data Processing**	**23 ECTS**
Study program	Smart Products & Solutions	
Position in curriculum	1st-3rd semester	
Categorization	Data generation and use	
Level	Second cycle, Master	
Previous knowledge	According to admission criteria	
Block course	No	
Participating students	Bachelor graduates	
Contributes to following modules	Connection to the modules PDE, DVA, MFE, WMF	
Recommended reading	<u>Introduction to Programming</u> • Klein(2014): Einführung in Python 3: Für Ein- und Umsteiger, Carl Hanser • Lutz(2014): Python - kurz & gut, O'Reilly • Lorig,(2015): Java-Programmierung für Anfänger: Programmieren lernen ohne Vorkenntnisse, CreateSpace Independent Publishing Platform • Ratz, Scheffler, Seese, Wiesenberger (2014): Grundkurs Programmieren in Java, Carl Hanser • Sweigart (2016): Routineaufgaben mit Python automatisieren: Praktische Programmierlösungen für Einsteiger, dpunkt • Theis (2014): Einstieg in Python: Ideal für Programmieranfänger geeignet, Galileo Computing <u>Embedded Systems</u> • Berns, Schürmann, Trapp (2010): Eingebettete Systeme: Systemgrundlagen und Entwicklung eingebetteter Software, Vieweg+Teubner • Eisenlöffl (2012): Embedded-Software entwickeln: Grundlagen der Programmierung eingebetteter Systeme - Eine Einführung für Anwendungsentwickler, dpunkt.verlag • Lange, Bodgan, Schweizer (2015): Eingebettete Systeme: Entwurf, Modellierung und Synthese, De Gruyter Oldenbourg • Noergaard (2012): Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, Newnes • White (2011): Making Embedded Systems: Design Patterns for Great Software, O'Reilly • Wüst (2010): Mikroprozessortechnik: Grundlagen, Architekturen, Schaltungstechnik und Betrieb von Mikroprozessoren und Mikrocontrollern, Vieweg+Teubner <u>Data Science</u> • Dorschel (2015): Praxishandbuch Big Data: Wirtschaft – Recht – Technik, Springer Gabler Verlag • Grus (2016): Einführung in Data Science: Grundprinzipien der Datenanalyse mit Python, O'Reilly Media • McKinney (2015): Datenanalyse mit Python: Auswertung von Daten mit Pandas, NumPy und IPython, O'Reilly Media • Guido, Mueller (2016): Introduction to Machine Learning with Python, O'Reilly Media • Gibson, Patterson (2016): Deep Learning: The Definitive Guide: A Practitioner's Approach, O´Reilly Media <u>Model Based Analytics</u> • Camach, Alba (2009): Model Predictive Control, Springer London • Dittmar, Pfeiffer (2004): Modellbasierte prädiktive Regelung: Eine Einführung für Ingenieure, Oldenbourg Verlag München <u>Business Technology Platforms</u> • Brause (2013): Betriebssysteme: Grundlagen und Konzepte, 3. Aufl., Springer Verlag • Becker,Pant (2011): Android 2 – Grundlagen und Programmierung, 2. Aufl.,	

	dpunkt.verlag • Bengel, et al. (2008): Masterkurs Parallele und Verteilte Systeme: Grundlagen und Programmierung von Multicoreprozessoren, Multiprozessoren, Cluster und Grid, Vieweg +Teubner Verlag • Correia ,Nuno (2015): Internet of Things with SAP HANA: Build Your IoT Use Case With Raspberry PI, Arduino Uno, HANA XSJS and SAPUI5, CreateSpace Independent Publishing Platform • Fasel, Meier (2016): Big Data: Grundlagen, Systeme und Nutzungspotenziale, Springer Vieweg • Fuchß (2009): Mobile Computing – Grundlagen und Konzepte für mobile Anwendungen, Carl Hanser Verlag • Gleim, Schüle (2011): Multicore-Software: Grundlagen, Architektur und Implementierung in C/C++, Java und C#, dpunkt.verlag • Sankaranarayanan (2016): Learning IBM Bluemix, Packt Publishing • Silberschatz, Galvin, Gagne (2009): Operating System Concepts, John Wiley • Schüle (2010) Paralleles Rechnen – Performancebetrachtungen zu Gleichungslösern, Oldenbourg Wissenschaftsverlag • Tanenbaum (2007): Modern Operating Systems, Pearson Studium
	<u>Specialist journals</u> • Data Science and Engineering, Springer • OBJEKTSpektrum, SIGS DATACOM GmbH • Entwickler Magazin, Tools – Technologies – Techniques, Software & Support Media • Elektronik Praxis, Vogel • Elektronik Journal, Hüthig
Acquisition of skills	<u>Introduction to Programming (VO)</u> Students: • have an overview of programming languages • know the interaction process between hardware and software • know the structure of programs • are able to write programs in a standard language <u>Introduction to Programming (UE)</u> Students: • are able to use the development environment for a programming language • are able to solve simple problems in a program <u>Embedded Systems (VO)</u> Students: • know the architecture and components of embedded systems and are able to explain the advantages and disadvantages of different construction types • know the development process and tools • are able to define the demands placed on an embedded system, evaluate relevant concepts and select those concepts which are best suited <u>Embedded Systems (UE)</u> Students: • are able to analyze the demands placed on an embedded system and, based on that analysis, select appropriate embedded systems for the task at hand • are able to create the development environment needed for an embedded system • are able to create and implement simple programs (operation, processing sensor data, connecting to actuators, communication) <u>Data Science (VO)</u> Students: • are able to describe the content, results/uses and operating methods of data science • are able to turn "questions" into requirements in the context of data science • based on this, are able to define the process and tools and to implement/apply these <u>Data Science (UE)</u> Students:

	• are familiar with a software with libraries for carrying out data analysis • are able to use this software • can carry out appropriate evaluations and analyses using the software for defined examples <u>Model Based Analytics:</u> Students: • know the content, results/uses and operating methods of model based advanced analytics • are able to develop a model for a technical system, to calibrate this model and to generate condition information using software tools <u>Business Technology Platforms:</u> Students: • know the relevant platforms • are able to define criteria for selecting the right platform and to carry out an analysis in a structured way • can define necessary interfaces and specify their requirements
Course title	**Introduction to Programming**
Number of ECTS	2 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Lecture
Examination methods	Written examination
Course content	• Programming languages (classification, principles, history) • Detailed look at a modern programming language (e.g. Python, Java) • Structure of programs • Types of data, operators, process structures • Development environment • Typical working steps
Course title	**Introduction to Programming**
Number of ECTS	4 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Creating a development environment • Programming (input, debugging, execution) • Independent planning and programming for different tasks based on the programming language taught in the lecture
Course title	**Embedded Systems**
Number of ECTS	2 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Lecture
Examination methods	Written examination
Course content	• System solutions and architecture of embedded systems and characteristics • Embedded hardware (processors, storage units, I/O, buses) • Embedded software (operating system, middleware, application, driver) • Realtime operation (classification, implementation) • Multiprocessing

	• Distributed systems • Development of embedded systems with focus on software • Programming
Course title	**Embedded Systems**
Number of ECTS	4 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Familiarization with the platforms (e.g. Raspberry Pi) and the development environment • Carrying out simple applications regarding the processing of sensors and the controlling of actuators • Implementing the different methods of data transmission • Carrying out a complex final project
Course title	**Data Science**
Number of ECTS	1.5 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Lecture
Examination methods	Written examination
Course content	• Introduction (data, information, knowledge, time components, goals) • Data process (collection, preparation, analysis, presentation) • Data preparation (adjustment, re-modelling, re-scaling, storage) • Approaches to analyzing data • Presentation/visualization of results • Software (open source and proprietary software) • Machine learning - process, approaches, implementation
Course title	**Data Science**
Number of ECTS	4 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Practical course
Examination methods	Assignments
Course content	• Introduction to software which will be used (e.g. Python) • Collecting and preparing data using software • Analysis and presentation of exemplary data using different approaches (e.g. regression, decision trees, etc.)
Course title	**Model Based Analytics**
Number of ECTS	2.5 ECTS
Position in curriculum	2nd semester
Teaching and learning methods	Integrated course
Examination methods	Written examination and project documentation

Course content	• Introduction (areas of application, uses, concept) • Process for deriving a formal framework using a model • Models and simulations. • Development of models, simulation and calibration • Determining/diagnosing status, predictive diagnosis • Implementation/application • Analysis of case studies • Application of knowledge acquired to a learning project
Course title	**Business Technology Platforms**
Number of ECTS	3 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Integrated course
Examination methods	Written examination and project documentation
Course content	• Fundamentals for using information systems in a business • Requirements regarding the use of data • Concepts/technologies for data processing and its properties (data maintenance, data access, processing, results, governance and security) • Overview of relevant cloud platforms (application, strengths & weaknesses) • Methods and criteria for selecting platforms • Interfaces/integration • Hands-on use of selected special platforms

Business, Management and Leadership

Module number	**Module title**	**Number of ECTS**
WMF	**Business, Management and Leadership**	**19 ECTS**
Study program	Smart Products & Solutions	
Position in curriculum	1st-4th semester	
Categorization	Digital transformation in companies	
Level	Second cycle, Master	
Previous knowledge	According to admission criteria	
Block course	No	
Participating students	Bachelor graduates	
Contributes to following modules	PDE, MFE, DVA	
Recommended reading	Digital Transformation • Caudron, Van Peteghem (2016): Digital Transformation: A Model to Master Digital Disruption, BookBaby • Rauser (2016): Digital Strategy: A Guide to Digital Business Transformation, CreateSpace Independent Publishing Platform Project Management & Teambuilding • Biech (2009): The Pfeiffer book of successful team-building tools, Pfeiffer • Barker, Cole (2012), What the best project managers know, do and say, Pearson • Ding (2016): Key Project Management based on effective project thinking, Springer • Karlgaard, Malone (2015): Team Genius: The New Science of High- Marle, Vidal (2016): Managing complex, high risk projects, Springer • Schwindt, Zimmermann (2015): Handbook on Project Management and Scheduling, Springer • Performing Organizations, HarperBusiness • PMBOOK guide (2013): A guide to the project management body of knowledge, Project Management Institute • Roudias (2015): Mastering principles and practices in PMBOK, PRINCE2, and Scrum, Pearson FT Press Stratefy, Business Model / Process Model and Business Plan • Clement, Schreiber (2016): Internet-Ökonomie: Grundlagen und Fallbeispiele der vernetzten Wirtschaft, Springer Gabler Verlag • Hoffmeister (2015): Digital Business Modelling: Digitale Geschäftsmodelle entwickeln und strategisch verankern, Carl Hanser Verlag • Kubr, Ilar, Marchesi (2016): Planen, gründen, wachsen: Mit dem professionellen Businessplan zum Erfolg, Redline Verlag • McGrath (2013): The End of Competitive Advantage: How to Keep Your Strategy Moving as Fast as Your Business, Harvard Business Review Press • McGrath, Macmillan (2009): Discovery-Driven Growth: A Breakthrough Process to Reduce Risk and Seize Opportunity, Harvard Business Review Press • Ries (2011): The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Viking • Slama, et al. (2015): Enterprise IoT: Strategies and Best Practices for Connected Products and Services, O'Reilly Media • Suter, Vorbach, Weitlaner (2014): Die Wertschöpfungsmaschine: - Strategie operativ verankern - Prozessmanagement umsetzen - Operational-Excellence erreichen, Carl Hanser Verlag Product Management • Aumayr (2016): Erfolgreiches Produktmanagement: Tool-Box für das professionelle Produktmanagement und Produktmarketing, Springer Gabler Verlag • Hermann, Albers (2007): Handbuch Produktmanagement: Strategieentwicklung – Produktplanung – Organisation - Kontrolle, Gabler Verlag • Pichler (2013): Agiles Produktmanagement mit Scrum: Erfolgreich als Pro	

	-duct Owner arbeiten, dpunkt.verlag Data Protection and Ethics • Floridi (2015): The Ethics of Information, Oxford University Press • Lynskey (2015): The Foundations of EU Data Protection Law, Oxford University Press Change Management • Doppler, Lauterburg (2014): Change Management: Den Unternehmenswandel gestalten, 13. Aufl., campus Verlag • Berner (2015): Change!: 20 Fallstudien zu Sanierung, Turnaround, Prozessoptimierung, Reorganisation und Kulturveränderung, Schäffer Poeschl • Höfler, et al. (2014): Abenteuer Change Management: Handfeste Tipps aus der Praxis für alle, die etwas bewegen wollen, Frankfurter Allgemeine Buch Leadership • Cham (2015): Personal and Organizational Excellence through Servant Leadership, Springer International Publishing • Graeme (2006) Managing people and organizations in changing contexts, Elsevier • Moran, Harris, Moran (2007): Managing cultural differences, Elsevier • Ruckdäschel (2015): Leadership of networks and performance, Wiesbaden, Springer Gabler • Steiber, Alänge (2016): The Silicon Valley Model, Springer Online • Yukl (2010): Leadership in organizations, Upper Saddle River Pearson Value Selling & Communication • Gallo (2016): The Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any Audience, Mcgraw-Hill Education • Miller, Heiman, Tuleja (2011): The New Conceptual Selling, Kogan Page • Miller, Heiman, Tuleja (2011): The New Strategic Selling: The Unique Sales System Proven Successful by the World's Best Companies, Kogan Page • Minto (2008): The New Strategic Selling: The Unique Sales System Proven Successful by the World's Best Companies, Financial Times Prent • Zelazny (2006): Say it With Presentations: How to Design and Deliver Successful Business Presentations, Mcgraw-Hill Education
	Specialist journals • International Journal of Project Management, Elsevier • Project Management Journal, John Wiley & Sons • Harvard Business Review • Datenschutz konkret, Manz
Acquisition of skills	Digital Transformation Students: • know important trends for companies based on digitalization • know the potential of digital transformation for companies and are able to describe development paths • know the challenges associated with digital transformation for traditional companies and know the importance of smart products as part of digitalization Project Management & Teambuilding Students: • are familiar with the approaches, functions, methods and instruments of project management • have the ability to work on a project, to organize themselves and to form teams as well as to lead these teams in an appropriate way • know frameworks for project management • know the fundamental communication, presentation and negotiation techniques as well as the most important leadership tools • are able to apply these tools (taking into consideration the respective situation and staff) in order to lead project teams and to consult with stakeholders

	Strategy, Business Model / Process Model and Business Plan (VO) Students: • understand the fundamentals of the digital economy • know the connections between strategy, business model, business process model and process and methods in order to develop these • know the requirements and elements of a business plan and are able to develop these Strategy, Business Model / Process Model and Business Plan (UE) Students: • are able to develop business models based on pre-determined framework conditions and to transfer these models into a business process model • are able to develop a business plan based on this Product Management Students: • know the tasks related to project management • know the process and the appropriate tools and are able to apply these • know the special characteristics of product management when it comes to smart products and solutions Data Protection and Ethics Students: • are able to explain fundamental positions of technical and business ethics using examples • are able to describe the steps to forming an ethical judgement and apply these to case studies from the world of business/technology • have a good understanding of the fundamental laws, regulations and strategies concerning data protection Change Management Students: • know the importance of change management for improving processes and introducing systems and new technology • understand the different phases of the change process • understand the different types of change • understand change models • are familiar with techniques for dealing with resistance • are able to apply change management techniques Leadership Students: • know the importance and influence or leadership and the tasks of a leader/manager • know leadership techniques and instruments • know the elements of good communication • know the challenges presented by digitalization and the influence of these challenges on leadership as well as relevant approaches to these challenges • are able to successfully lead members of staff both "on site" and "virtually" Value Selling & Communication Students: • are able to transfer technical content to a perspective which is targeted at a specific audience and with a specific use • are able create appropriate documentation and to hold convincing presentations, taking into account the respective situation and occasion
Course title	**Digital Transformation (E)**
Number of ECTS	1.5 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Integrated course

Examination methods	Assignments
Course content	• Digital trends and change waves • Difference between digital and traditional companies and their development paths • Design levels, framework conditions and challenges of digital change • Frameworks for evaluating digital maturity • Smart products – development • Ecosystem IoT and data • Use cases of smart products and solutions
Course title	**Project Management & Teambuilding (E)**
Number of ECTS	1.5 ECTS
Position in curriculum	1st semester
Teaching and learning methods	Integrated course
Examination methods	Project handbook
Course content	• Fundamentals of project management • Project management methods and tools • Roles in projects • Management of problems, conflicts, risks and crises • Theory/models and approaches to teambuilding • Tools to support teambuilding
Course title	**Strategy, Business Model / Process Model and Business Plan**
Number of ECTS	3 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Integrated course
Examination methods	Written examination and assignments
Course content	• Fundamentals of 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
Course title	**Strategy, Business Model / Process Model and Business Plan**
Number of ECTS	4 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Practical course
Examination methods	Final report
Course content	• Development of strategies and, building on that, business models and business process models • Developing business plans • Planning approaches to implementation with risk reduction
Course title	**Product Management**
Number of ECTS	2 ECTS
Position in curriculum	3rd semester

Teaching and learning methods	Integrated course
Examination methods	Written examination and assignments
Course content	• Special characteristics of smart products and solutions • New approaches to product management • Market research • Product strategy • Purchasing decisions / acceptance (drivers, obstacles) • Special aspects regarding launch and marketing • Data-based decisions • Life-cycle management
Course title	**Data Protection and Ethics (E)**
Number of ECTS	1.5 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Integrated course
Examination methods	Written examination
Course content	• Introduction to data protection • Definition of personal data, data register • Informational self-determination, laws and regulations on data protection • Rights of those affected • Organizational measures to protect personal data • Basic positions of forming ethical judgements • Methods of ethical argumentation • Concept of responsibility • Ethics in engineering and business • Ethics in connected information and knowledge-based societies
Course title	**Change Management**
Number of ECTS	2 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Integrated course
Examination methods	Final report
Course content	• Types of change • Phases in change processes • Change process models (e.g. Lewin, Tuckman) • Change process tools (e.g. force field analysis, TPC matrix, etc.) • Movement of organizations, creating buy-in • Method toolbox for change and transformation • Best practices for convincing communication
Course title	**Leadership (E)**
Number of ECTS	1.5 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Integrated course
Examination methods	Final report
Course content	• Fundamentals of leadership theories • Model of maturity-oriented leadership according to Hersey and Blanchard

	• Leadership tools for real-life situations: Communication and agreement on objectives, delegation and monitoring, conflict management and motivation • Fundamentals of hierarchy-free leadership • Role structures and role conflicts • Active listening and communication • Performance reviews and evaluations • Leadership in the digital world • Role of leadership in change processes
Course title	**Value Selling & Communication**
Number of ECTS	2 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Integrated course
Examination methods	Project report
Course content	• Analysis of motivation/framework conditions of clients • Selling and buying process • Use-oriented selling • Creating documentation and paperwork • Convincing presentations

Master Thesis / Research and Development

Module number	**Module title**	**Number of ECTS**
MFE	**Master Thesis / Research and Development**	**29 ECTS**
Study program	Smart Products & Solutions	
Position in curriculum	3rd and 4th semester	
Categorization	Cross-cutting skills	
Level	Second cycle, Master	
Previous knowledge	According to admission criteria	
Block course	No	
Participating students	Bachelor graduates	
Contributes to following modules	None	
Recommended reading	<u>International study trip</u> Thomas (2014): Cross-Cultural Management: Essential Concepts, Sage Publications Beise (2014): Lead Markets. Country-Specific Success Factors of the Global Diffusion of Innovations, Physica-Verlag Heidelberg <u>Practical/research project</u> Patzak, Rattay,(2014): Projekt Management. Leitfaden zum Management von Projekten, Projektportfolios und projektorientierten Unternehmen, Linde Verlag Schöneck, Voß, (2013): Das Forschungsprojekt: Planung, Durchführung und Auswertung einer quantitativen Studie, Springer VS <u>Academic Writing Skills</u> Schütz, Röbken, (2016): Bachelor- und Masterarbeiten verfassen: Abschlussarbeiten in Organisationen, Springer Gabler Theisen, Theisen (2013): Wissenschaftliches Arbeiten: Erfolgreich bei Bachelor- und Masterarbeit, Vahlen	
Acquisition of skills	Students learn to independently process and analyze a specific topic using academic methods and a (self-)reflective approach with diverse aspects of a topic, presentation/communication of results. The topic can be derived from an external client or from a research project. <u>International study trip</u> Students: • know the specific cultural characteristics of the respective country when it comes to management, strategy and leadership • know the specific characteristics of the country regarding smart products and solutions (technology, acceptance, business models, etc.) • know and understand the research strategy/research system of the host country when it comes to smart products and solutions • understand the framework conditions for lead-market applications <u>Practical/research project</u> Students: • are able to analyze and define tasks as required • are able to derive an appropriate academic methodology based on the task given • can find, read and analyze the relevant literature (state-of-the-art approaches) • are able to apply research results to real-life problems • are able to lead projects with relevant content related to the study program • are able to structure projects/project teams (results, times, resources)	

	• know the tasks and responsibilities of project staff <u>Academic Writing Skills</u> Students: • know academic methods • are able to formulate research questions and write an exposé on a subject-specific topic • are able to analyze a subject-specific topic using academic methods • are able to carry out research into literature independently <u>Master Thesis</u> Students: • are able to produce an independent piece of academic writing on a topic relevant to the study program <u>Master Thesis Colloquium</u> Students: • know how scientific reviews are carried out • know how to present results to the scientific community • know how to critically analyze scientific results
Course title	**International Study Trip (E)**
Number of ECTS	3 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Integrated course
Examination methods	Final report
Course content	• International and strategic management in a country-specific context. • R&D strategy and systems at state level • Approaches to technology and innovation
Course title	**Practical/Research Project:**
Number of ECTS	4 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Project
Examination methods	Project handbook
Course content	• Working in a team and team organization • Coming up with a research question/topic • Selecting a suitable method and corresponding tools • Planning, carrying out and steering projects • Integrative application of acquired skills and knowledge • Preparing and presenting results • Self-reflection
Course title	**Academic Writing Skills**
Number of ECTS	2 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Seminar
Examination methods	Assignment
Course content	• Advanced methods and approaches to academic writing • Designing academic research projects • Qualitative and quantitative research methods • State-of-the-art literature research • Preparation for exposé for Master thesis

	• Information on formal requirements for Master thesis
Course title	**Master Thesis**
Number of ECTS	18 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Master Thesis
Examination methods	Master Thesis
Course content	• Independent piece of academic writing on a topic relevant to the study program
Course title	**Master Thesis Colloquium**
Number of ECTS	2 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Seminar
Examination methods	Presentation
Course content	• Support and advice for students while writing their Master thesis • Presentation and discussion of research question / hypothesis, structure of Master thesis, academic methods and formal requirements of Master thesis

Elective (ELE)

Module number	**Module title**	**Number of ECTS**
ELE	**Elective**	**6 ECTS**
Study program	Smart Products & Solutions	
Position in curriculum	3rd and 4th semester	
Categorization	Cross-cutting skills	
Level	Second cycle, Master	
Previous knowledge	Details on any previous knowledge required will be given in each	
Block course	If necessary	
Participating students	Depends on course offered	
Contributes to following modules	None	
Recommended reading	Depends on course chosen	
Acquisition of skills	Every Master study program at the FH Kufstein offers one elective per winter semester and summer semester. This elective is open to students of all Master study programs. The result is a diverse collection of courses giving students the chance to deepen their knowledge in a wide range of fields.	

Course title	**Elective I (E)**
Number of ECTS	3 ECTS
Position in curriculum	3rd semester
Teaching and learning methods	Integrated course
Examination methods	Depends on course chosen
Course content	Elective courses include for example: • Starting a business • International business restructuring • Mergers & acquisitions • Crisis situations from a business perspective • Quantitative process and quality management • Selected ERP modules (project management, HR, manufacturing integration) • Market research and demand analysis • Systemic management • Selected leadership techniques • Strategic cost management The Master in Smart Products & Solutions offers a range of courses as electives. These include rapid prototyping, creative problem-solving and innovation management.
Course title	**Elective II (E)**
Number of ECTS	3 ECTS
Position in curriculum	4th semester
Teaching and learning methods	Integrated course
Examination methods	Depends on course chosen
Course content	Elective courses include for example: • Starting a business • International business restructuring • Mergers & acquisitions • Crisis situations from a business perspective • Quantitative process and quality management • Selected ERP modules (project management, HR, manufacturing integration) • Market research and demand analysis • Systemic management • Selected leadership techniques • Strategic cost management The Master in Smart Products & Solutions offers a range of courses as electives. These include rapid prototyping, creative problem-solving and innovation management.

2.4 Internship

Internship (Semester, duration in weeks per semester)		No	

2.5 Semester abroad

Mandatory semester abroad (semester)		No	There is no mandatory semester abroad. An international study trip is planned in the 3rd semester with block courses held at a partner university.

3 ADMISSION CRITERIA

The general admission criteria are set out in the current version of the University of Applied Sciences Studies Act (FHG), § 4, which states that the educational requirement for admission to a University of Applied Sciences Master study program shall be a completed subject-relevant University of Applied Sciences Bachelor study program or the completion of an equivalent study program at a recognized domestic or foreign post-secondary educational institution.

1) For this study program, "subject-relevant" refers to Bachelor study programs which focus mainly on the fields of engineering and economics. For engineering in particular (with reference to ISCED 2013, Fields of Education and Training 06/071/072) a total teaching volume of at least 30 ECTS is required. Furthermore, subject-relevant study programs should also teach aspects of business and economics such as cost accounting, marketing and management. These courses should make up a total teaching volume of at least 10 ECTS.

2) The FH Kufstein Tirol strives to achieve close links between Bachelor and Master study programs, in line with the aims of the Bologna Process. After successfully completing a Bachelor study program, graduates have several options for continuing their studies either at the FH Kufstein Tirol or at another institution. Graduates of the following study programs at the FH Kufstein Tirol (both full-time and part-time) would be entitled to be admitted to this Master study program:
   - Industrial Engineering & Management
   - Web Business & Technology
   - European Energy Business

3) For all study programs at the FH Kufstein Tirol, courses and examinations are held in German and English. Therefore, international students (from non-German-speaking countries) must provide proof of their German language skills.

4) The Director of Studies for the Master study program Smart Products & Solutions is responsible for checking that each applicant meets the necessary admission criteria.