HS PF

MODULE HANDBOOK

Master of Science
Industrial Management (MIM)

HS PF Engineering

Study program director:
Prof. Dr. Ansgar Kühn

SPO 2024
Start of studies from WS 2024/2025

Current status as of: 01.04.2024

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Note on the modules:
The duration of the modules is usually one semester. The section "Semester of study" shows the respective semester. If a module extends over two consecutive semesters, the two semesters in question are shown in the above section. Admission is generally intended for the winter and summer semesters. However, the subjects are only offered once a year. Semesters 1 and 2 can therefore also be completed in reverse order.
The Master's study program in Industrial Management has an English-only specialization (MIM English Track), which is primarily aimed at applicants without sufficient knowledge of German. Up to six places are available for this track. The English Track can only be started in the winter semester. The combination of English language lectures from the MIM and English language courses from the Master of Engineering and Management (MEM) study program enables students to complete 90 ECTS credits in English for the English Track. For the sake of clarity, the range of subjects is presented as a separate part of this module handbook.
Examinations are generally graded on a scale from 1 ("very good") to 5 ("fail"). The exceptions to this are the courses marked "ungraded examination performance" (UPL) in the special section of the study and examination regulations - and in this module handbook. These are graded as "pass" and "fail", see § 24 (1, 2) SPO.

The courses (lectures and seminars) are designed for groups of 20-25 students.

Note on the scope of written work:
The scope of a Master's thesis is typically 70-100 pages. Project theses typically comprise 40-60 pages, although other artifacts can also be defined in advance as the expected project result.

LIST OF ABBREVIATIONS

CP	Credit according to the ECTS system (1 CP corresponds to 25-30 working hours. This document contains the workload calculations with the maximum possible scope of work. You can also decide to do correspondingly fewer hours)
ECTS	European Credit Transfer and Accumulation System
PLH	Examination performance Term paper
PLK	Examination performance Written exam
PLM	Examination performance Oral examination
PLP	Exam performance Project work
PLR	Examination performance Presentation
PLS	Examination performance Course work
PLT	Examination performance Thesis
PVL	Examination prerequisite
PVL-MP	Examination prerequisite for the Master's examination
PVL-PLT	Preliminary work for the thesis
STA1	First stage of study
STA2	Second stage of study
SWS	Semester hour (S) per week
UPL	Ungraded examination performance

I. Regular course of study MIM

1. Leadership

"Leadership"	
Code number	MWI10029
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10030 Leading Virtual Teams MWI10031 Applied Leadership
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Dr. Jasmin Mahadevan
Teachers	Applied Leadership: Prof. Dr. Cathrin Eireiner Leading Virtual Teams: Prof. Dr. Jasmin Mahadevan
Assignment to the curriculum	MIM - compulsory subject 1st semester
Teaching forms of the courses of the module	Lecture, seminar-based teaching, workshop, coaching, real project
Goals	**Applied Leadership:** The students • are familiar with the tasks and different roles of a manager • are familiar with different leadership concepts and their context dependency • have explored leadership mentality • are familiar with the relevance of personality and attitude in management tasks **Leading Virtual Teams:** The students • are aware of the importance of virtual team collaboration as an increasingly relevant form of organization and work and know when and how it should (not) be used • know the requirements for virtual team collaboration and know methods and ways to achieve these requirements • can analyze and evaluate virtual teamwork in a structured way and derive situation- and case-specific criteria for 'good leadership' from this • Are aware of the importance of self-leadership and leadership identity as well as team-based and decentralized leadership for successful virtual team collaboration
Interdisciplinary qualification goals	The module makes a significant contribution to personal development, especially as it strengthens the ability to (self-)reflect, to interact with other people/in a team and other social skills. This enables responsible leadership in the context of virtual, hybrid and non-virtual organizations.
Contents	**Applied Leadership:** • Management tools • Management concepts • Management mandate and roles

	• Understanding of leadership • Leadership mentality and leadership **skills** **Leading Virtual Teams:** • Basics and forms of virtual team collaboration • Opportunities and risks of virtual teams • Special requirements for leadership in virtual teams • Special features of interdisciplinary, diverse, intercultural, flexible and/or global virtual teams • Key topics for successful leadership in virtual teams, e.g. cultural intelligence and intercultural competence; leadership identity and styles; trust, learning and change; interaction and technology; diversity and dispersion, new forms of work (work-from-home, work-from-anywhere, flexible work arrangements, etc.)
Literature	**Applied Leadership:** • Alznauer, M. (2016) Leading Naturally: The Evolutionary Source Code of Leadership. Springer. Frankfurt am Main. • McDonald, S.M. (2016) Leadership Attitude: How Mindset and Action can Change Your World. LeadershipHQ **Leading Virtual Teams:** • Mahadevan, J. (2024) Virtual Team Collaboration.Springer: Frankfurt am Main. • Further literature will be announced in the seminar
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Slides, flipchart, projector, lecture in the form of presentations, case studies, interactive board, behaviour simulations, reflection

2. Networked Systems & Artificial Intelligence

"Netzwerketzte Systeme & Künstliche Intelligenz" / "Networked Systems & Artificial Intelligence"	
Code number	MWI10032
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10033 Applications of Artificial Intelligence MWI10034 Networked Systems - Basics & Applications
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Dr. Bernhard Kölmel
Teachers	Applications of Artificial Intelligence: Prof. Dr. Raphael Volz Networked Systems - Basics & Applications: Prof. Dr. Bernhard Kölmel
Assignment to the curriculum	MIM - compulsory subject 1st semester
Teaching forms of the courses of the module	Lecture, seminar-based teaching
Goals	**Applications of Artificial Intelligence:** • The aim of this course is to provide students with an understanding of the various applications of artificial intelligence (AI). Basic concepts and techniques of AI are presented and explained using concrete application examples. • Students will learn how AI algorithms and models can be used in different areas such as image recognition, language processing, data analysis and decision making. They will be familiarized with the relevant AI methods and tools to develop, implement and evaluate these applications. • Another aim is to make students aware of the ethical and social aspects of AI applications. They should understand the impact AI systems can have on privacy, the labour market, social justice and other areas and how these aspects should be taken into account when developing and implementing AI applications. **Networked Systems - Basics & Applications:** • The main objective of this course is to provide students with basic knowledge of networked systems. The basic concepts, technologies and protocols for communication and interaction between networked devices and systems are covered. • Students will develop an understanding of how networked systems are used in various application areas such as the Internet of Things (IoT), smart cities, Industry 4.0 and smart homes. They will learn how to design,

	implement and operate these systems, including aspects such as network topologies, protocols, security and data management. • Another aim is to teach students the importance and challenges of interoperability and scalability in networked systems. They should learn how different components and devices can communicate and work together and understand the options and limitations of these systems in order to develop effective and reliable applications.
Interdisciplinary qualification goals	• Systemic thinking: An interdisciplinary qualification objective is to develop the ability to think systemically. This includes an understanding of complex interrelationships and interactions between different disciplines, subject areas and stakeholders. Systemic thinking enables complex problems to be analyzed holistically and comprehensive solutions to be developed that transcend the boundaries of individual disciplines. • Innovation and creativity: Another goal is to promote innovation and creativity through the exchange and integration of knowledge from different disciplines. By combining different perspectives and ideas, innovative approaches and solutions can be developed. Interdisciplinary cooperation makes it possible to break through conventional thought patterns and find new ways of tackling complex problems. • Ethics and sustainability: An important qualification objective is to create an awareness of ethical and sustainable aspects. Interdisciplinary collaboration requires consideration of social, environmental and economic impacts. Students should recognize the ethical implications of their actions and be able to develop sustainable solutions that have long-term positive effects. • Scientific communication: Another goal is to develop the ability to effectively communicate complex scientific content across disciplines. Students should be able to present their knowledge and research findings in an understandable and authentic way, both to experts and to a wider audience., Interdisciplinary projects can be successfully communicated and collaboration with experts from other disciplines can be facilitated through clear and convincing communication**.**
Contents	**Applications of Artificial Intelligence:** 1. Introduction to Artificial Intelligence: The course begins with a basic introduction to the field of artificial intelligence. Students learn about the concepts, goals and applications of AI. 2. AI algorithms and models: Various AI algorithms and models are introduced, including machine learning, neural networks, decision trees, genetic algorithms and more. Students will learn how these algorithms work and what applications they have. 3. Applications of AI: The course deals with specific examples of applications of artificial intelligence. These include areas such as image recognition, language processing, automated decision-making, robotics, autonomous vehicles and many others.

	4. Data analysis and pre-processing: As AI is heavily dependent on data, students learn how to analyze and pre-process data and prepare it for AI applications. Topics such as data cleansing, feature extraction, dimension reduction and data visualization are covered. 5. Ethics and responsibility: The course also deals with the ethical and social aspects of artificial intelligence applications. Students learn to identify and discuss ethical issues related to data protection, discrimination, trust and transparency. They will also discuss how AI systems can be developed and used responsibly. **Networked Systems - Basics & Applications:** 1. Introduction to networked systems: The course begins with an introduction to the fundamentals of networked systems. Students learn about the concepts, principles and technologies behind the networking of devices and systems. 2. Network architectures and protocols: Various network architectures such as client-server, peer-to-peer and cloud computing are covered. In addition, the most important network protocols such as TCP/IP, HTTP, MQTT and others are presented and their applications explained. 3. Internet of Things (IoT): One focus is on the Internet of Things, an important area of application for networked systems. Students learn the basics of IoT, including sensor technologies, connectivity, data management and application areas such as smart homes, wearables and Industry 4.0. 4. Security and data protection Security and data protection aspects are also covered in light of increasing networking and data exchange. Students learn the basic principles of network security, encryption techniques, access controls and data protection regulations to protect networked systems from threats. 5. Applications and case studies: The course also includes the study of specific applications and case studies of networked systems. This may include smart cities, intelligent transportation systems, health technologies or other areas. Students will gain insights into real-world applications and discuss the challenges, opportunities and implications of networked systems in different areas.
Literature	**Applications of Artificial Intelligence:** • Russell, S., & Norvig, P. (2016). *Artificial Intelligence: A Modern Approach* (3rd ed.). Pearson. • Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning.* MIT Press. • Murphy, K. P. (2012). *Machine Learning: A Probabilistic Perspective*. MIT Press. • Bishop, C. M. (2006). *Pattern Recognition and Machine Learning.* Springer. • **Networked Systems - Basics & Applications:** • Ray, P. P. (2021). *Internet of Things: A Hands-On Approach* (2nd ed.). Springer.

	• Li, S., Da Xu, L., & Zhao, S. (2020). *Internet of Things for Industry 4.0: Design, Technologies, and Applications.* CRC Press. • Yan, Z., Zhang, P., & Vasilakos, A. V. (Eds.). (2020). *Internet of Things: Principles and Paradigms*. Wiley. • Misra, S., Agarwal, P. K., & Mahadevappa, V. G. (Eds.). (2020). *Handbook of Research on IoT and Big Data Technologies for Enterprises.* IGI Global.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs. 120 hours of lecture preparation and exam preparation.
Media forms	Lecture with discussion, case studies with seminar exercises in small groups

3. Research Methods & Innovation

"Forschungsmethoden & Innovation" / "Research Methods & Innovation"	
Code number	MWI10007
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10008 Research Methods MWI10009 Product Strategy/Product Development
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLR/PLK (60 minutes)
Teaching language	German or English
Person responsible for the module	Prof. Dr. Henning Hinderer
Teachers	Research Methods: Prof. Dr. Ludwig Martin/Prof. Dr. Rebecca Bulander Product Strategy/Product Development: Prof. Dr. Henning Hinderer/Prof. Dr. Rainer Wunderlich
Assignment to the curriculum	MIM, MEM - compulsory subject 1st semester
Teaching forms of the courses of the module	Seminar-based teaching and exercises, intensive block course with follow-up dates, project
Goals	**Research Methods:** Students are familiar with the variety of research approaches and can classify them in terms of scientific theory. Students can design (smaller) research projects and draw up project plan based on their specialist knowledge of common qualitative and quantitative methods. Students can recognize associated ethical issues and formulate solutions. They are also able to critically evaluate and classify their own results, as well as those of others, likewise with regard to applied methodology and methods. Students are aware of the special interdisciplinary nature of the study program with regard to research approaches and know how to deal with this, also in terms of the admissibility of different perspectives and creative solution finding. They can also classify their own contributions from a specialist perspective through the connection to specialist knowledge from the elective modules of the study program. **Product Strategy/Product Development:** After a methodical introduction to strategic product planning strategic product planning, creativity methods and methods of market-oriented product development, students are able to systematically develop a new product from the idea to marketing. Important components are the creative generation of ideas and the derivation of the contents of a suitable business model and a market launch strategy. The aim is to develop your own product idea in small groups, which is to be implemented as a prototype for a planned market launch. There is the option of presenting the product ideas in further modules, e.g. IDP or Master's thesis with a business plan.

Interdisciplinary qualification goals	The module contributes to the further development of students' understanding of methods and the development and marketing of products. The connection between the application and understanding of methods (research and product development) and the corresponding results is trained. This also applies to the evaluation of areas of application of methods and their limitations.
Contents	**Research Methods:** The prevailing paradigms of knowledge acquisition are explained and differentiated from one another. Various approaches and related methodologies are explained through a research problem-oriented approach to the topic. Engineering as well as social science (incl. business research) approaches and related methods are introduced, deepened and discussed using exercises and case studies Questions regarding the validity and reliability of various methods and procedures are discussed with reference to empirical research.. Questions of scientific ethics are explored and solutions are developed using examples. Basic forms of good scientific practice (e.g. declarations of consent in surveys, avoiding plagiarism, dealing with generative AI) are dealt with. The procedure for classifying one's own contribution in existing knowledge (state of the art / state of science) is explained and practiced. Source work and the critical processing of what has been read into own texts is demonstrated and consolidated through exercises. **Product Strategy/Product Development:** Methods of strategic product planning and market-oriented product development are explained, discussed and applied experimentally with the aim of preparing the strategic and market-oriented development of a product based on an individual idea. Strategic product planning: - Approaches to agile product development (scenario creation, design thinking approaches, BMC) - Practical application of strategic methods in the context of a product concept Procedure for generating ideas: - Analysis of trends and innovative technologies as approaches for generating ideas - Design thinking and other creativity methods Methods of market-oriented product development: - Product development methods - Market research and testing methods - Market launch strategy with communication plan
Literature	**Research Methods:** - Leedy, P. D., Ormrod, J. E. (2016): *Practical Research: Planning and Design.* 11th Edition, Pearson. - Bryman, A., Bell, E. (2015): *Business Research Methods*. 4th Edition, Oxford University Press: Oxford. - Kornwachs, K. (2010): *Technological Knowledge - Emergence, Methods, Structures.* Acatech/Springer: Berlin. (PDF available online) Lindenlauf, F. (2022): *Scientific work in engineering and natural sciences*. Springer Spektrum: Berlin. - Various texts that are provided on E-Learning **Product Strategy/Product Development:**

	- Porter, M. E. (2013): *Competitive Strategies*. 12th ed., Campus: Frankfurt/Main. - Lewrick, M., Link, P., Leifer, L. (2018): *The Design Thinking Playbook.* 2nd ed., Vahlen: Munich. - Osterwalder, A., Pigneur, Y. (2011): *Business Model Generation*. Campus: Frankfurt/Main. - Gerstbach, I. (2016): *Design thinking in the company. A Workbook for the introduction of Design Thinking*. Gabal: Offenbach. - Bland, D. J., Osterwalder, A., Smith, A., & Papadakos, T. (2020). *Testing business ideas*: Wiley: Hoboken. - Ulrich, K. T., Eppinger S. D. (2012): *Product design and development.* 5th Edition, McGraw-Hill: New York.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	PowerPoint, reprints, interactive group tasks, individual tasks, interactive teaching discussion, research work (incl. library), discussion of models and drafts.

4. Interdisciplinary Innovation/Research Project

"Interdisziplinäres Innovations-/Forschungsprojekt" / "Interdisciplinary Innovation / Research Project"	
Code number	MWI10010
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	9
SWS	6
Associated courses	MWI10011 Innovation/Research Project Concept MWI10012 Innovation/Research Project Realization
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Parallel participation in the courses MWI10008 Research Methods and MWI10009 Product Strategy/Product Development
Type(s) of examination, duration (only for PLK/PLM)	PLP in each case
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	Innovation/Research Project Concept: all lecturers in the Industrial Engineering and Management department Innovation/Research Project Realization: all lecturers in the field of industrial engineering and management
Assignment to the curriculum	MIM, MEM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Project in small groups (4 people) under the intensive supervision of a teacher across both courses
Goals	Students are familiar with the variety of research approaches and can classify these in terms of scientific theory and apply them to specific projects. They are also familiar with a variety of innovation methods. Students can design (smaller) research/innovation projects and implement them prototypically to clarify relevant issues based on their specialist knowledge of common qualitative and quantitative methods. Students will be able to recognize any ethical issues that may arise and develop solutions. They are also able to critically evaluate and classify their own results, as well as those of others, likewise with regard to applied methodology and methods. Students are aware of the special interdisciplinary nature of the study program with regard to innovation and research approaches and know how to deal with this, likewise in terms of the admissibility of different perspectives and creative solution finding and feedback with the stakeholders of an envisaged market. They can also classify their own contributions professionally through the connection to specialist knowledge from the compulsory and elective modules of the study program. Students can develop, satisfactorily document and present solutions in an innovation project / a research project (also in cooperation with external companies). This also includes the possibility of publishing the work or its results.
Interdisciplinary qualification goals	The module contributes to management skills, teamwork and project management skills. It strengthens the ability to reflect critically and to solve problems creatively.

Contents	Possible research/innovation projects are presented by various lecturers at the beginning of the module. The research/innovation projects can be of a different nature and involve a wide variety of problems. • The lecturers teaching the elective modules specify the topics of the research/innovation project, which can also be carried out jointly with external companies. • The problems are always solved on a scientific basis and the project documentation is written as a scientific paper or as product documentation in a suitable form (drawing, parts list, product description, manual, etc.). • The project work ideally concludes with a scientific article worthy of publication or a concrete and detailed product/business idea, if possible including a functional prototype. The lecturers are available to the students as mentors, **Innovation/Research Project Concept:** The prevailing paradigms of knowledge acquisition are explained and differentiated from one another. Various approaches and related methodologies are explained through a research problem-oriented approach to the topic. Engineering as well as social science (incl. business research) approaches and related methods are introduced and intensively discussed using exercises and case studies. All aspects of product development are discussed with reference to innovation and application-oriented development - this includes methods of market research and target group analysis, documentation and validation of requirements as well as an iterative approach in the project. Questions regarding the validity and reliability of various methods and procedures for projects involving empirical research are also discussed. **Innovation/Research Project Realization:** Students work on a research/innovation project based on the knowledge gained in the Innovation/Research Project Design course and document it conclusively. Market and user feedback in innovation projects should, where possible, be determined on the basis of functional prototypes and taken into account in further development.
Literature	**Innovation/Research Project Concept:** • Leedy, P. D., Ormrod, J. E. (2016): *Practical Research: Planning and Design.* 11th Edition, Pearson. • Bryman, A., Bell, E. (2015): *Business Research Methods*. 4th Edition, Oxford University Press: Oxford. • Kornwachs, K. (2010): *Technological Knowledge - Emergence, Methods, Structures.* Acatech/Springer: Berlin. (PDF available online) • Großklaus, Rainer H. G. (2014): *From product idea to market success : planning, introducing and successfully managing innovations.* - 2nd ed. 2014 - Wiesbaden : Gabler Verlag, 2014. • Further literature as required **Innovation/Research Project Realization:** • - Bland, D. J., Osterwalder, A., Smith, A., & Papadakos, T. (2020). *Testing business ideas*: Wiley: Hoboken. • Engeln, Werner (2006): *Methods of product development*. Munich : Oldenbourg-Industrieverlag.

	• Schwarz, Erich J.; Dummer, Rita; Krajger, Ines (2007): *From the business idea to market success*. Vienna : Linde Verlag • Subject-specific literature depending on the respective project work.
Workload	Workload: 9 ECTS x 30 hours = 270 hours. Innovation/Research Project Concept: 3 ECTS Innovation/Research Project Realization: 6 ECTS Attendance time: 6 SWS x 15 weeks = 90 hours or attendance time in consultation with supervisor / project- leader
Media forms	Depending on the respective project work / supervisor: PowerPoint, reprints, interactive group tasks, physical or IT-based prototypes, interactive teaching discussion, research work (library).

5. Compulsory Elective Subjects "Focus"

Subjects amounting to 9 ECTS must be selected from the Master's courses offered by the WI department and/or other departments/faculties of the university in consultation with the head of the study program and the respective lecturer. Subjects are to be reported to the Examinations Office via a list or, if necessary, individually via a form.

Individual courses can be combined individually as well as entire elective modules. There is no entitlement to freedom from overlaps. A list of the possible elective subjects and modules in the study program can be viewed at the program management assistant’s office.

"Wahlpflichtfächer "Fokus"" / "Electives "Focus""	
Code number	MWI10023
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	9
SWS	6
Associated courses	MWI10024 Focus A MWI10025 Focus B MWI10026 Focus C
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Technical and organizational questions, especially for Master's courses that are not offered by the WI department, must be clarified in advance with the lecturer.
Type(s) of examination, duration (only for PLK/PLM)	In each case PLH/PLK/PLP/PLR (duration of exam according to the elective list)
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	The respective lecturers of the selected Master's courses on the elective list.
Assignment to the curriculum	MIM, MEM - Compulsory Elective Subject 1st/2nd semester
Teaching forms of the courses of the module	, Seminar-style teaching, lecture or project depending on the courses chosen.
Goals	Students acquire additional, in-depth knowledge within the framework of specialization subjects of their choice. The wide range of Master's courses offered by Pforzheim University gives students the opportunity to set individual priorities.
Interdisciplinary qualification goals	Depending on the selected courses
Contents	These depend on the courses selected from the elective list. Courses can be chosen from the Master's courses offered by all 3 faculties of the university in consultation with the head of the study program and the respective lecturer. The selectable subjects are placed in a list (elective list). Courses can be combined individually or taken as complete elective modules. There is no entitlement to admission or freedom from overlaps.
Literature	This depends on the courses selected from the elective list.
Workload	Workload: 9 ECTS x 30 hours = 270 hours. Attendance time: 6 SWS x 15 weeks = 90 hours attendance time

Media forms	Depending on the selected courses.

6. Major Industrial Management I

"Major Industrial Management I"	
Code number	MWI10045
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10046 Seminar Industrial Management A MWI10047 Seminar Industrial Management B
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	Seminar Industrial Management A: English Seminar Industrial Management B: German or English
Person responsible for the module	Prof. Dr. Ansgar Kühn
Teachers	Seminar Industrial Management A: N.N. Seminar Industrial Management B: N.N.
Assignment to the curriculum	MIM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Seminar/lecture/workshop
Goals	Students acquire in-depth knowledge and skills to enable effective management in industrial organizations. To this end, the module teaches both theoretical principles and practical application to enable students to take on various management tasks in a complex, technical environment. In particular, students learn about the special requirements of selected complex and interdisciplinary issues and are able to design convincing solutions. Where possible, the design of the module should take appropriate account of the students' initial qualifications and thus enable specific knowledge acquisition.
Interdisciplinary qualification goals	The module strengthens the ability for critical reflection and problem solving as well as interdisciplinary skills.
Contents	Industrial Management covers a wide range of topics. In addition to the topics covered in other modules, additional topics can be specifically included or deepened in the Industrial Management I major. This includes, among other things • Strategy and organization: aspects of organizational and operational structure, industry, competition and market analysis, strategy development and strategic planning • Operations Management: Principles and tools for the effective management of industrial operations processes. This includes process improvement, supply chain management, quality control and productivity improvement methods. • HR management: Management of HR in an industrial environment in all aspects along the HR lifecycle

	• Financial management: particular importance of decision-making and resource allocation, analysis, budgeting, controlling, investment decisions, risk assessment. • Sustainability & resilience: Integration of sustainable and environmentally friendly working methods and processes in manufacturing companies. CSR, sustainable and resilient supply chains, energy management, circular economy, green manufacturing
Literature	Will be announced by the lecturer.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Powerpoint, flipchart, practical presentation

7a. Major Engineering

One of the modules 7a, 7b or 7c must be completed in accordance with the certified entry qualification:

- 7a for students without a relevant technical Bachelor's degree;
- 7b for students with a technical Bachelor's degree;
- 7c for students who provide evidence of both technical and business entry qualifications from the Bachelor's study course, e.g. subjects amounting to 6 ECTS must be taken here in line with the WI qualification framework.

The choice between 7a/7b/7c is made after individual examination by the head of the study program within the framework of a binding study agreement.

"Major Engineering"	
Code number	MWI10060
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10049 Engineering Basics MWI10061 Fundamentals of Industrial Production
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	Engineering Basics: English Fundamentals of Industrial Production: German or English
Person responsible for the module	Prof. Dr. Ansgar Kühn
Teachers	Engineering Basics: Prof. Dr. Kai Oßwald Fundamentals of Industrial Production: N.N.
Assignment to the curriculum	MIM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Seminar-style lecture with practical exercises
Goals	**Engineering Basics:** • Teaching the basics of technical communication • Practicing engineering arithmetic • Introduction to basic engineering subjects **Fundamentals of Industrial Production:** • Introduction to the most basic manufacturing processes • Introduction to modern production methods • Basics of automated production
Interdisciplinary qualification goals	The module provides the most essential technical basics for students with little or no previous technical training. This creates the prerequisites for the technical subjects of the study program.

Contents	**Engineering Basics:**
	• Basics (1 unit)
	  ○ Calculations
	  ▪ Basics
	  ▪ Examples
	  ▪ Fermi problems
	  ○ Units

	• Technical drawing (2 units)
	  ○ descriptive geometry, projections, views
	  ○ Thread, dimensions
	  ○ Exercises
	• Technical mechanics (3 units)
	  ○ Forces and torques (central and general force systems)
	  ○ Tension and strength
	• Materials science (4 units)
	  ○ Metals: lattice, crystallites, dislocations, iron-carbon diagram
	  ○ Fundamentals of polymers
	  ▪ Origin and behaviour
	  ▪ Basic manufacturing processes
	• Electrical engineering (4 units)
	  ○ Direct current
	  ▪ Resistance, Kirchhoff's rules
	  ○ Alternating current
	  ▪ Transformers
	  ○ Three-phase current
	  ○ Power, energy
	  ○ Digital technology
	  ○ Calculating with electrical quantities
	
	Fundamentals of Industrial Production:
	• Manufacturing processes (5 units)
	  ○ Prototypes
	  ○ Reshaping
	  ○ Cutting
	  ○ Joining
	• Production and assembly methods (2 units)
	  ○ TPS
	  ○ 5S
	  ○ ...
	• Automation (5 units)
	  ○ PLC and CNC
	  ○ Components of automated machines
	  ○ Industry 4.0
	  ○ ...
	• Production metrology and quality (3 units)
	  ○ Tolerances
	  ○ Measuring and testing
	  ○ Quality and quality management

Literature	**Engineering Basics:** OBERG, Erik. *Machinery's Handbook, Toolbox & Calc Pro 2 Combo*. 2016. **Fundamentals of Industrial Production:** BENDER, Beate; GÖHLICH, Dietmar (eds.). *Dubbel pocket book for mechanical engineering applications*. Springer Berlin, 2020.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Slide presentations, video, blackboard notes

7b. Major Business

One of the modules 7a, 7b or 7c must be completed in accordance with the certified entry qualification:

- 7a for students without a relevant technical Bachelor's degree;
- 7b for students with a technical Bachelor's degree;
- 7c for students who provide evidence of both technical and business entry qualifications from the Bachelor's study course, e.g. subjects amounting to 6 ECTS must be taken here in line with the WI qualification framework.

The choice between 7a/7b/7c is made after individual examination by the head of the study program within the framework of a binding study agreement.

"Major Business"	
Code number	MWI10062
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10051 Business Management MWI10063 Cost Accounting and Financing
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration of examination (only for PLK/PLM)	Each PLH/PLK/PLM/PLR (60 minutes)
Teaching language	Business Management: English Cost Accounting and Financing: German or English
Person responsible for the module	Prof. Schnell
Teachers	Business Management: Prof. Schnell Cost Accounting and Financing: Prof. Schnell
Assignment to the curriculum	MIM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Seminar-based teaching including a business simulation workshop (BM) and lecture with practical exercises (KR&Finanzierung)
Goals	**Business Management:** Students are taught how business people think and act using a business simulation in the form of a workshop-style seminar. Students learn how to manage a company commercially and how to analyze and ensure effectiveness and efficiency within the company. Students learn how to use numerous business instruments such as market and SWOT analysis tools, product costing, cash flow calculation and the basics of accounting. **Cost Accounting and Financing:** Students learn the basics of cost accounting with a focus on product costing, cost element accounting and cost unit time accounting (income statement). In addition, the basics of corporate financing with capital requirement and investment planning as well as capital requirement coverage via various forms of financing are taught.
Interdisciplinary qualification goals	In addition to business expertise, which forms the core of teaching in this subject, other objectives and requirements for action

	that compete withbusiness activity are discussed with the students. This promotes ethical awareness in business enterprises. Furthermore, students learn to think beyond departments and functional areas in complex companies and to communicate and collaborate with each other in a variety of ways within the company.
Contents	**Business Management:** • Introduction to business management: Setting targets - developing markets - securing profitability - ensuring financing - monitoring targets with Bosch key figures • Business planning and budgeting (BP): Content, structure, process, parties involved • Analysis of the markets and alignment of the company to the market: market research and marketing • Capacity and financial planning in the company • Pricing and calculation: Basic principles of PPC (product costing) calculation at Bosch • Measurement of corporate target achievement with the help of Bosch-specific key figures, including EBIT, return on investment (ROI), break-even point, cockpit charts • Control of business development with the help of Bosch contribution margin accounting and the balance sheet **Cost Accounting and Financing:** • Basics of cost and activity accounting with cost unit accounting (product costing), cost element and cost center accounting and cost unit time accounting (profit and loss accounting) • Fundamentals of financing with capital requirements and investment planning/budgeting as well as capital requirements coverage using equity and debt financing instruments.
Literature	**Business Management:** • Wöhe/Döring/Brösel: *Introduction to General Business Administration* - Vahlen-Verlag : Munich / latest edition • Wöhe/Kaiser/Döring: *Exercise book for the introduction to general business administration* - Vahlen-Verlag : Munich / latest edition **Cost Accounting and Financing:** • Schmidt, A.: Kostenrechnung: Grundlagen der Vollkosten-, Deckungsbeitrags- und Plankostenrechnung sowie des Kostenmanagements - Kohlhammer-Verlag : München / latest edition
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	**Business Management:** Workshop using pin boards, flip charts and manual for business simulation plus a set of slides on the basics of business administration. **Cost Accounting and Financing:** Lecture notes, supplemented by numerous case studies, which are worked on in plenary sessions and/or in small groups

7c. Major Industrial Management II

One of the modules 7a, 7b or 7c must be completed in accordance with the certified entry qualification:

- 7a for students without a relevant technical Bachelor's degree;
- 7b for students with a technical Bachelor's degree;
- 7c for students who provide evidence of both technical and business entry qualifications from the Bachelor's study course, e.g. subjects amounting to 6 ECTS must be taken here in line with the WI qualification framework.

The choice between 7a/7b/7c is made after individual examination by the head the study program within the framework of a binding study agreement.

"Major Industrial Management II"	
Code number	MWI10064
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10053 Focus D MWI10066 Focus E
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Technical and organizational issues, especially for Master's courses that are not offered by the WI department, must be clarified in advance with the lecturer.
Type(s) of examination, duration (only for PLK/PLM)	In each case PLH/PLK/PLP/PLR (duration of exam according to the elective list)
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	The respective lecturers of the selected Master's courses on the elective list.
Assignment to the curriculum	MEM - Compulsory elective subject 1st/2nd semester
Teaching forms of the courses of the module	Seminar-style teaching, lecture or project depending on the courses chosen.
Goals	Students acquire additional, in-depth knowledge within the framework of specialization subjects of their choice. The wide range of Master's courses offered by Pforzheim University gives students the opportunity to set individual priorities.
Interdisciplinary qualification goals	Depending on the selected courses
Contents	These depend on the courses selected from the elective list. Courses can be chosen from the Master's courses offered by all 3 faculties of the university in consultation with the head of the study program and the respective lecturer. The selectable subjects are posted in a list (elective list). Courses can be combined individually or taken as complete elective modules. There is no entitlement to admission or freedom from overlaps.
Literature	This depends on the courses selected from the elective list.
Workload	Workload: 6 ECTS x 30 hours = 180 hours.

	Attendance time: 4 SWS x 15 weeks = 60 hours attendance time
Media forms	Depending on the selected courses.

8. **Technology Management and Negotiation**

"Technologiemanagement und Verhandlungsführung" / "Technology Management and Negotiations B-to-B"	
Code number	MWI10067
Semester of study	2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10068 Technology and Innovation Management MWI10069 Negotiation B-to-B
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Technology Management: PLH/PLR Conducting Negotiations: PLP/PLH/PLR
Teaching language	German or English
Person responsible for the module	Prof. Dr. Peter
Teachers	Technology and Innovation Management: N.N. Negotiation B-to-B: Prof. Dr. Moritz Peter
Assignment to the curriculum	MIM - compulsory subject 2nd semester
Teaching forms of the courses of the module	Teaching of the most important concepts in lecture style, as well as practical exercises and case studies, Seminar-based teaching with project work
Goals	**Technology and Innovation Management:** Students learn how practical technology and innovation management is structured, which scientific principles it is based on and which concepts and methods can be used in practice. This includes strategic planning activities, the generation of new ideas, their evaluation, the selection of ideas and finally their implementation in marketable products and processes. **Negotiating B-to-B:** After this course, the participating students should: - demonstrate an in-depth understanding of the negotiation process in the context of a sourcing process/project, - be familiar with the most important negotiation strategies and tactics in the context of a professional purchase and sale, - be able to properly prepare, conduct and document negotiations as a buyer and/or seller, - understand how a negotiator can improve the outcome of a negotiation - even under difficult circumstances, - react to manipulation, conflicts and threats without losing sight of the original objectives. After completing this course, students should therefore be able to prepare and conduct negotiations effectively and successfully and conclude transactions as a professional buyer or seller.
Interdisciplinary qualification goals	The module contributes to • students' acquisition of in-depth knowledge of the interrelationships in innovation development and implementation in companies. By working on practical examples, they increase their systemic thinking skills by gaining an understanding of complex interrelationships and interactions between different disciplines, specialist areas and actors. This

	increases their ability to analyze complex problems in relation to innovation development and implementation or their organizational implications in companies holistically and to develop comprehensive solutions that go beyond the boundaries of individual departments (R&D, sales, production, marketing, ...) and disciplines (business administration, engineering, ...). • the consolidation of innovation and creativity through the exchange and integration of knowledge from different disciplines in the course. By combining different perspectives and ideas, innovative approaches and solutions can be developed. Interdisciplinary cooperation makes it possible to break through conventional thought patterns and find new ways of tackling complex problems. • improvement of the students' teamwork skills (negotiating in groups) and enhancement of entrepreneurial thinking (negotiation goals and strategy).
Contents	**Technology and Innovation Management:** The focus is on identifying impulses for innovation (taking into account open innovation approaches and cooperation with other organizations), on dealing with and implementing innovation ideas in the company (evaluation, selection, technical implementation of ideas and market launch as well as suitable processes) and a strategic view (taking into account megatrends and future scenarios). The role that business models play in the development of innovations and the aspects that need to be considered in order to integrate sustainability as an important future topic in innovation management are also presented. **Negotiating B-to-B:** The course topics are based on the structure of an exemplary negotiation process in the B-to-B context. The course therefore includes the following content: - Pre-negotiation phase: Identification of your own interests and the interests of the other party; alternatives, strengths/weaknesses etc. Establishing a suitable negotiation strategy; assigning suitable roles and tactics for the upcoming meetings (documented in a negotiation playbook) - Negotiation phase: taking and defending the lead in negotiation talks before an agreement is finally reached (documented in coherent meeting minutes) - Closing and follow-up phase: intelligently closing or canceling the deal. Monitoring compliance with agreements and response strategies in the event of breaches of agreements (documented by contract and letter/email exchange).
Literature	**Technology and Innovation Management:** • Tidd, J.; Bessant, J. (2013): *Managing Innovation: Integrating Technological, Market and Organizational Change*, Wiley • Vahs, D.; Brem, A. (2015): *Innovationsmanagement - Von der Idee zur efolgreichen Vermarktung*, 5th edition, Schäffer-Poeschel Verlag. • Spath, D. et al. (2011): *Technology Management. Grundlagen, Konzepte, Methoden,* Fraunhofer Verlag. **Negotiating B-to-B:**

	(1) Downloads: Lecture slides and supplementary materials (2) The following recommendations: • Fisher, R., Ury, W. L., & Patton, B. (1991). *Getting to Yes: Negotiating Agreement Without Giving In*. New York, NY: Penguin. • Lewicki, R. J., Saunders, D. M., & Barry, B. (2015). *Essentials of Negotiation* (6th ed.). New York, NY: McGraw-Hill. • Raiffa, H., Richardson, J., & Metcalfe, D. (2002). *Negotiation Analysis: The Science and Art of Collaborative Decision Making.* Cambridge, MA: Belknap. • Thompson, L. L. (2009). *The Mind and Heart of the Negotiator* (4th ed.). Upper Saddle River, NJ: Pearson
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Lecture slides, exercise materials, practical exercises in small groups, group discussions and the development of case studies

9. Processes & Data

"Prozesse & Daten" / "Process and Data"	
Code number	MWI10070
Semester of study	2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10071 Process Analytics MWI10072 Data Management & Analytics
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Basic knowledge of descriptive statistics
Type(s) of examination, duration of examination (only for PLK/PLM)	PLK/PLP/PLH/PLR (60 minutes)
Teaching language	German
Person responsible for the module	Prof. Dr. Viola Galler
Teachers	Process Analytics: Prof. Dr. Rebecca Bulander Data Management & Analytics: Prof. Dr. Viola Galler
Assignment to the curriculum	MIM - compulsory subject 2nd semester
Teaching forms of the courses of the module	Lecture and seminar-style teaching
Goals	**Process Analytics:** Students learn - the basics of business process management, - how they can collect and analyze data from various sources to improve business processes, - analyze processes with process mining. **Data Management & Analytics:** Students - know the basics of data management, data structures and the data analysis process - can carry out a data analysis (using selected methods based on case studies) and interpret the results - know procedures for validating/checking analysis methods and can apply them
Interdisciplinary qualification goals	The module promotes abstract and networked thinking.
Contents	**Process Analytics:** The course deals with the methods and techniques of process analysis, process management and process mining and shows how these can be used to improve business processes. **Data Management & Analytics:** Basics of data management, introduction to data structures and the process of data analysis, introduction to an analysis tool (e.g. R, Python, Knime, Excel,...), selected methods of data analysis using case studies, introduction to the communication of results (data storytelling)
Literature	**Process Analytics:** • Van der Aalst, W. (2016): *Process Mining: Data Science in Action*. 2nd Edition. Springer: Munich and others.

	• Reinkemeyer, L. (2020): *Process mining in action: principles, use cases and outlook*. Cham: Springer **Data Management & Analytics:** • v.d. Hude, M. (2020): *Predictive Analytics and Data Mining*, Springer Vieweg, Wiesbaden. • Ghavami, P. (): *Big Data Analytics Methods,* 2nd Edition. De Gruyter, Boston/Berlin. • Further literature will be announced in good time
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Slides, flipchart, projector, interactive board, university e-learning platform (Moodle), computer pool

10. Capstone

"Capstone Seminar"	
Code number	MWI10027
Semester of study	3rd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10028 Capstone Seminar COL6996 Scientific Colloquium
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	In-depth knowledge through successful completion of the lectures from all areas of the MEM curriculum.
Type(s) of examination, duration of examination (only for PLK/PLM)	Capstone Seminar: PLH/PLR/PLP Scientific Colloquium: UPL
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	Capstone Seminar: Alternating lecturers from the field of industrial engineering Subject-specific Colloquium: Examiners can be all full-time professors.
Assignment to the curriculum	MIM, MEM - compulsory subject 3rd semester
Teaching forms of the courses of the module	Project work, seminar, case study seminar, individual performance, preferably in cooperation with companies
Goals	**Capstone Seminar:** The MIM curriculum aims to provide students with a consecutive and generalist education, combined with the students' individual areas of interest and development goals. The latter are achieved through the selection of elective subjects and, under certain circumstances, courses at partner universities abroad. At the end of their studies, all students should apply and deepen the breadth of their acquired knowledge and skills as part of the capstone seminar and work out the interdependencies between the individual subject areas. **Scientific Colloquium:** Students should set individual, subject-specific priorities or reduce identified weaknesses within the framework of individual achievements. Aspects of individual career planning are given special consideration. The ability for critical self-reflection is encouraged.
Interdisciplinary qualification goals	The module contributes to teamwork and (self-)reflection skills.
Contents	**CapstoneSeminar:** The seminar is organized by the supervising professors depending on the number of participants and the topics to be dealt with. Project work and/or case study seminars are used for this purpose. The topics as well as the timing and proportion of attendance phases are determined at an early stage. **Scientific Colloquium:** The content depends on the individual student. In particular, aspects of academic or professional qualifications, e.g. additional qualifications that go beyond the curriculum, should be taken

	into account here. Key topics are determined in consultation with the supervising professors.
Literature	Will be announced in good time.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. of which attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Seminar / project or interactive teaching discussion

11. Master's Thesis

"Master's thesis"	
Code number	THE6880
Semester of study	3rd semester
Level	Expert level
Credits	24
SWS	0
Associated courses	None
Participation requirements according to SPO	The Master's thesis can be submitted in the 2nd semester at the earliest.
Recommended prerequisites	Solid technical and scientific knowledge from the Master's program.
Type(s) of examination, duration of examination (only for PLK/PLM)	PLT
Teaching language	German or English
Person responsible for the module	Responsible professor
Teachers	All professors in the department.
Assignment to the curriculum	MEM, MIM - compulsory subject 3rd semester
Teaching forms of the courses of the module	Thesis
Goals	The Master's thesis should demonstrate that students are able to work independently on an industrial engineering problem using scientific methods and solve it precisely and efficiently within a specified period of time. They are able to research available scientific findings and develop their own theoretical concepts and models. They are proficient in the methods and procedures required for this. They select suitable methods and apply them correctly, adapt them, develop them further and check their viability when dealing with complex problems.
Interdisciplinary qualification goals	Students are able to present complex topics in a differentiated manner from various perspectives and prepare them according to academic standards. They demonstrate their sound analytical thinking skills and critical judgment using scientific methods in their thesis. They are able to plan and carry out an academic thesis project over a longer period of time and demonstrate their resilitence in doing so. Students also demonstrate that they can formulate their results clearly and write them down in an academically appropriate form. Students are able to critically compare their own results with other approaches, evaluate their own results and thus make a significant contribution to the scientific field or provide a solution with high practical relevance.
Contents	As a rule, a topic belonging to the faculty's main research areas is given to the students to work on or alternatively proposed by the students. In terms of subject content, it must be assigned to the field of economics and/or engineering and cover current subject-specific or interdisciplinary issues and topics.

	Students independently research the available scientific findings, carry out their own analyses and formulate theses. They also carry out their own empirical or theoretical research in order to achieve the objectives of the Master's thesis. To this end, they develop their own theories and models, which they verify or refute from a scientific point of view.
Literature	Topic-specific literature, to be chosen by the students.
Workload	Processing time 6 months, 24 ECTS x 30 hours = 720 hours of work including documentation.
Media forms	Printed and electronic copies.

II. Course of study in the English Track

1. Leadership

"Leadership"	
Code number	MWI10029
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10030 Leading Virtual Teams MWI10031 Applied Leadership
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Dr. Jasmin Mahadevan
Teachers	Applied Leadership: Prof. Dr. Cathrin Eireiner Leading Virtual Teams: Prof. Dr. Jasmin Mahadevan
Assignment to the curriculum	MIM - compulsory subject 1st semester
Teaching forms of the courses of the module	Lecture, seminar-based teaching, workshop, coaching, real project
Goals	**Applied Leadership:** The students • are familiar with the tasks and different roles of a manager • are familiar with different leadership concepts and their context dependency • have explored leadership mentality • are familiar with the relevance of personality and attitude in management tasks **Leading Virtual Teams:** The students • are aware of the importance of virtual team collaboration as an increasingly relevant form of organization and work and know when and how it should (not) be used • know the requirements for virtual team collaboration and know methods and ways to achieve these requirements • can analyze and evaluate virtual teamwork in a structured way and derive situation- and case-specific criteria for 'good leadership' from this • Are aware of the importance of self-leadership and leadership identity as well as team-based and decentralized leadership for successful virtual team collaboration
Interdisciplinary qualification goals	The module makes a significant contribution to personal development, especially as it strengthens the ability to (self-)reflect, to interact with other people/in a team and other social skills. This enables responsible leadership in the context of virtual, hybrid and non-virtual organizations.
Contents	**Applied Leadership:** • Management tools • Management concepts

	• Management mandate and roles • Understanding of leadership • Leadership mentality and leadership **skills** **Leading Virtual Teams:** • Basics and forms of virtual team collaboration • Opportunities and risks of virtual teams • Special requirements for leadership in virtual teams • Special features of interdisciplinary, diverse, intercultural, flexible and/or global virtual teams • Key topics for successful leadership in virtual teams, e.g. cultural intelligence and intercultural competence; leadership identity and styles; trust, learning and change; interaction and technology; diversity and dispersion, new forms of work (work-from-home, work-from-anywhere, flexible work arrangements, etc.)
Literature	**Applied Leadership:** • Alznauer, M. (2016) Leading Naturally: The Evolutionary Source Code of Leadership. Springer. Frankfurt am Main. • McDonald, S.M. (2016) Leadership Attitude: How Mindset and Action can Change Your World. LeadershipHQ **Leading Virtual Teams:** • Mahadevan, J. (2024) Virtual Team Collaboration.Springer: Frankfurt am Main. • Further literature will be announced in the seminar
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Slides, flipchart, projector, lecture in the form of presentations, case studies, interactive board, behaviour simulations, reflection

2. Networked Systems & Artificial Intelligence

"Netzwerketzte Systeme & Künstliche Intelligenz" / "Networked Systems & Artificial Intelligence"	
Code number	MWI10032
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10033 Applications of Artificial Intelligence MWI10034 Networked Systems - Basics & Applications
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Dr. Bernhard Kölmel
Teachers	Applications of Artificial Intelligence: Prof. Dr. Raphael Volz Networked Systems - Basics & Applications: Prof. Dr. Bernhard Kölmel
Assignment to the curriculum	MIM - compulsory subject 1st semester
Teaching forms of the courses of the module	Lecture, seminar-based teaching
Goals	**Applications of Artificial Intelligence:** • The aim of this course is to provide students with an understanding of the various applications of artificial intelligence (AI). Basic concepts and techniques of AI are presented and explained using concrete application examples. • Students will learn how AI algorithms and models can be used in different areas such as image recognition, language processing, data analysis and decision making. They will be familiarized with the relevant AI methods and tools to develop, implement and evaluate these applications. • Another aim is to make students aware of the ethical and social aspects of AI applications. They should understand the impact AI systems can have on privacy, the labour market, social justice and other areas and how these aspects should be taken into account when developing and implementing AI applications. **Networked Systems - Basics & Applications:** • The main objective of this course is to provide students with basic knowledge of networked systems. The basic concepts, technologies and protocols for communication and interaction between networked devices and systems are covered. • Students will develop an understanding of how networked systems are used in various application areas such as the Internet of Things (IoT), smart cities, Industry 4.0 and smart homes. They will learn how to design,

	implement and operate these systems, including aspects such as network topologies, protocols, security and data management. • Another aim is to teach students the importance and challenges of interoperability and scalability in networked systems. They should learn how different components and devices can communicate and work together and understand the options and limitations of these systems in order to develop effective and reliable applications.
Interdisciplinary qualification goals	• Systemic thinking: An interdisciplinary qualification objective is to develop the ability to think systemically. This includes an understanding of complex interrelationships and interactions between different disciplines, subject areas and stakeholders. Systemic thinking enables complex problems to be analyzed holistically and comprehensive solutions to be developed that transcend the boundaries of individual disciplines. • Innovation and creativity: Another goal is to promote innovation and creativity through the exchange and integration of knowledge from different disciplines. By combining different perspectives and ideas, innovative approaches and solutions can be developed. Interdisciplinary cooperation makes it possible to break through conventional thought patterns and find new ways of tackling complex problems. • Ethics and sustainability: An important qualification objective is to create an awareness of ethical and sustainable aspects. Interdisciplinary collaboration requires consideration of social, environmental and economic impacts. Students should recognize the ethical implications of their actions and be able to develop sustainable solutions that have long-term positive effects. • Scientific communication: Another goal is to develop the ability to effectively communicate complex scientific content across disciplines. Students should be able to present their knowledge and research findings in an understandable and authentic way, both to experts and to a wider audience., Interdisciplinary projects can be successfully communicated and collaboration with experts from other disciplines can be facilitated through clear and convincing communication**.**
Contents	**Applications of Artificial Intelligence:** 6. Introduction to Artificial Intelligence: The course begins with a basic introduction to the field of artificial intelligence. Students learn about the concepts, goals and applications of AI. 7. AI algorithms and models: Various AI algorithms and models are introduced, including machine learning, neural networks, decision trees, genetic algorithms and more. Students will learn how these algorithms work and what applications they have. 8. Applications of AI: The course deals with specific examples of applications of artificial intelligence. These include areas such as image recognition, language processing, automated decision-making, robotics, autonomous vehicles and many others.

	9. Data analysis and pre-processing: As AI is heavily dependent on data, students learn how to analyze and pre-process data and prepare it for AI applications. Topics such as data cleansing, feature extraction, dimension reduction and data visualization are covered. 10. Ethics and responsibility: The course also deals with the ethical and social aspects of artificial intelligence applications. Students learn to identify and discuss ethical issues related to data protection, discrimination, trust and transparency. They will also discuss how AI systems can be developed and used responsibly. **Networked Systems - Basics & Applications:** 6. Introduction to networked systems: The course begins with an introduction to the fundamentals of networked systems. Students learn about the concepts, principles and technologies behind the networking of devices and systems. 7. Network architectures and protocols: Various network architectures such as client-server, peer-to-peer and cloud computing are covered. In addition, the most important network protocols such as TCP/IP, HTTP, MQTT and others are presented and their applications explained. 8. Internet of Things (IoT): One focus is on the Internet of Things, an important area of application for networked systems. Students learn the basics of IoT, including sensor technologies, connectivity, data management and application areas such as smart homes, wearables and Industry 4.0. 9. Security and data protection Security and data protection aspects are also covered in light of increasing networking and data exchange. Students learn the basic principles of network security, encryption techniques, access controls and data protection regulations to protect networked systems from threats. 10. Applications and case studies: The course also includes the study of specific applications and case studies of networked systems. This may include smart cities, intelligent transportation systems, health technologies or other areas. Students will gain insights into real-world applications and discuss the challenges, opportunities and implications of networked systems in different areas.
Literature	**Applications of Artificial Intelligence:** • Russell, S., & Norvig, P. (2016). *Artificial Intelligence: A Modern Approach* (3rd ed.). Pearson. • Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning.* MIT Press. • Murphy, K. P. (2012). *Machine Learning: A Probabilistic Perspective*. MIT Press. • Bishop, C. M. (2006). *Pattern Recognition and Machine Learning.* Springer. • **Networked Systems - Basics & Applications:** • Ray, P. P. (2021). *Internet of Things: A Hands-On Approach* (2nd ed.). Springer.

	• Li, S., Da Xu, L., & Zhao, S. (2020). *Internet of Things for Industry 4.0: Design, Technologies, and Applications.* CRC Press. • Yan, Z., Zhang, P., & Vasilakos, A. V. (Eds.). (2020). *Internet of Things: Principles and Paradigms*. Wiley. • Misra, S., Agarwal, P. K., & Mahadevappa, V. G. (Eds.). (2020). *Handbook of Research on IoT and Big Data Technologies for Enterprises.* IGI Global.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs. 120 hours of lecture preparation and exam preparation.
Media forms	Lecture with discussion, case studies with seminar exercises in small groups

3. Research Methods & Innovation

"Forschungsmethoden & Innovation" / "Research Methods & Innovation"	
Code number	MWI10007
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10008 Research Methods MWI10009 Product Strategy/Product Development
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLR/PLK (60 minutes)
Teaching language	German or English
Person responsible for the module	Prof. Dr. Henning Hinderer
Teachers	Research Methods: Prof. Dr. Ludwig Martin/Prof. Dr. Rebecca Bulander Product Strategy/Product Development: Prof. Dr. Henning Hinderer/Prof. Dr. Rainer Wunderlich
Assignment to the curriculum	MIM, MEM - compulsory subject 1st semester
Teaching forms of the courses of the module	Seminar-based teaching and exercises, intensive block course with follow-up dates, project
Goals	**Research Methods:** Students are familiar with the variety of research approaches and can classify them in terms of scientific theory. Students can design (smaller) research projects and draw up project plan based on their specialist knowledge of common qualitative and quantitative methods. Students can recognize associated ethical issues and formulate solutions. They are also able to critically evaluate and classify their own results, as well as those of others, likewise with regard to applied methodology and methods. Students are aware of the special interdisciplinary nature of the study program with regard to research approaches and know how to deal with this, also in terms of the admissibility of different perspectives and creative solution finding. They can also classify their own contributions from a specialist perspective through the connection to specialist knowledge from the elective modules of the study program. **Product Strategy/Product Development:** After a methodical introduction to strategic product planning strategic product planning, creativity methods and methods of market-oriented product development, students are able to systematically develop a new product from the idea to marketing. Important components are the creative generation of ideas and the derivation of the contents of a suitable business model and a market launch strategy. The aim is to develop your own product idea in small groups, which is to be implemented as a prototype for a planned market launch. There is the option of presenting the product ideas in further modules, e.g. IDP or Master's thesis with a business plan.

Interdisciplinary qualification goals	The module contributes to the further development of students' understanding of methods and the development and marketing of products. The connection between the application and understanding of methods (research and product development) and the corresponding results is trained. This also applies to the evaluation of areas of application of methods and their limitations.
Contents	**Research Methods:** The prevailing paradigms of knowledge acquisition are explained and differentiated from one another. Various approaches and related methodologies are explained through a research problem-oriented approach to the topic. Engineering as well as social science (incl. business research) approaches and related methods are introduced, deepened and discussed using exercises and case studies Questions regarding the validity and reliability of various methods and procedures are discussed with reference to empirical research.. Questions of scientific ethics are explored and solutions are developed using examples. Basic forms of good scientific practice (e.g. declarations of consent in surveys, avoiding plagiarism, dealing with generative AI) are dealt with. The procedure for classifying one's own contribution in existing knowledge (state of the art / state of science) is explained and practiced. Source work and the critical processing of what has been read into own texts is demonstrated and consolidated through exercises. **Product Strategy/Product Development:** Methods of strategic product planning and market-oriented product development are explained, discussed and applied experimentally with the aim of preparing the strategic and market-oriented development of a product based on an individual idea. Strategic product planning: - Approaches to agile product development (scenario creation, design thinking approaches, BMC) - Practical application of strategic methods in the context of a product concept Procedure for generating ideas: - Analysis of trends and innovative technologies as approaches for generating ideas - Design thinking and other creativity methods Methods of market-oriented product development: - Product development methods - Market research and testing methods - Market launch strategy with communication plan
Literature	**Research Methods:** - Leedy, P. D., Ormrod, J. E. (2016): *Practical Research: Planning and Design.* 11th Edition, Pearson. - Bryman, A., Bell, E. (2015): *Business Research Methods*. 4th Edition, Oxford University Press: Oxford. - Kornwachs, K. (2010): *Technological Knowledge - Emergence, Methods, Structures.* Acatech/Springer: Berlin. (PDF available online) Lindenlauf, F. (2022): *Scientific work in engineering and natural sciences*. Springer Spektrum: Berlin. - Various texts that are provided on E-Learning **Product Strategy/Product Development:**

	- Porter, M. E. (2013): *Competitive Strategies*. 12th ed., Campus: Frankfurt/Main. - Lewrick, M., Link, P., Leifer, L. (2018): *The Design Thinking Playbook.* 2nd ed., Vahlen: Munich. - Osterwalder, A., Pigneur, Y. (2011): *Business Model Generation*. Campus: Frankfurt/Main. - Gerstbach, I. (2016): *Design thinking in the company. A Workbook for the introduction of Design Thinking*. Gabal: Offenbach. - Bland, D. J., Osterwalder, A., Smith, A., & Papadakos, T. (2020). *Testing business ideas*: Wiley: Hoboken. - Ulrich, K. T., Eppinger S. D. (2012): *Product design and development.* 5th Edition, McGraw-Hill: New York.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	PowerPoint, reprints, interactive group tasks, individual tasks, interactive teaching discussion, research work (incl. library), discussion of models and drafts.

4. Interdisciplinary Innovation/Research Project

"Interdisziplinäres Innovations-/Forschungsprojekt" / "Interdisciplinary Innovation / Research Project"	
Code number	MWI10010
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	9
SWS	6
Associated courses	MWI10011 Innovation/Research Project Concept MWI10012 Innovation/Research Project Realization
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Parallel participation in the courses MWI10008 Research Methods and MWI10009 Product Strategy/Product Development
Type(s) of examination, duration (only for PLK/PLM)	PLP in each case
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	Innovation/Research Project Concept: all lecturers in the Industrial Engineering and Management department Innovation/Research Project Realization: all lecturers in the field of industrial engineering and management
Assignment to the curriculum	MIM, MEM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Project in small groups (4 people) under the intensive supervision of a teacher across both courses
Goals	Students are familiar with the variety of research approaches and can classify these in terms of scientific theory and apply them to specific projects. They are also familiar with a variety of innovation methods. Students can design (smaller) research/innovation projects and implement them prototypically to clarify relevant issues based on their specialist knowledge of common qualitative and quantitative methods. Students will be able to recognize any ethical issues that may arise and develop solutions. They are also able to critically evaluate and classify their own results, as well as those of others, likewise with regard to applied methodology and methods. Students are aware of the special interdisciplinary nature of the study program with regard to innovation and research approaches and know how to deal with this, likewise in terms of the admissibility of different perspectives and creative solution finding and feedback with the stakeholders of an envisaged market. They can also classify their own contributions professionally through the connection to specialist knowledge from the compulsory and elective modules of the study program. Students can develop, satisfactorily document and present solutions in an innovation project / a research project (also in cooperation with external companies). This also includes the possibility of publishing the work or its results.
Interdisciplinary qualification goals	The module contributes to management skills, teamwork and project management skills. It strengthens the ability to reflect critically and to solve problems creatively.

Contents	Possible research/innovation projects are presented by various lecturers at the beginning of the module. The research/innovation projects can be of a different nature and involve a wide variety of problems. • The lecturers teaching the elective modules specify the topics of the research/innovation project, which can also be carried out jointly with external companies. • The problems are always solved on a scientific basis and the project documentation is written as a scientific paper or as product documentation in a suitable form (drawing, parts list, product description, manual, etc.). • The project work ideally concludes with a scientific article worthy of publication or a concrete and detailed product/business idea, if possible including a functional prototype. The lecturers are available to the students as mentors, **Innovation/Research Project Concept:** The prevailing paradigms of knowledge acquisition are explained and differentiated from one another. Various approaches and related methodologies are explained through a research problem-oriented approach to the topic. Engineering as well as social science (incl. business research) approaches and related methods are introduced and intensively discussed using exercises and case studies. All aspects of product development are discussed with reference to innovation and application-oriented development - this includes methods of market research and target group analysis, documentation and validation of requirements as well as an iterative approach in the project. Questions regarding the validity and reliability of various methods and procedures for projects involving empirical research are also discussed. **Innovation/Research Project Realization:** Students work on a research/innovation project based on the knowledge gained in the Innovation/Research Project Design course and document it conclusively. Market and user feedback in innovation projects should, where possible, be determined on the basis of functional prototypes and taken into account in further development.
Literature	**Innovation/Research Project Concept:** • Leedy, P. D., Ormrod, J. E. (2016): *Practical Research: Planning and Design.* 11th Edition, Pearson. • Bryman, A., Bell, E. (2015): *Business Research Methods*. 4th Edition, Oxford University Press: Oxford. • Kornwachs, K. (2010): *Technological Knowledge - Emergence, Methods, Structures.* Acatech/Springer: Berlin. (PDF available online) • Großklaus, Rainer H. G. (2014): *From product idea to market success : planning, introducing and successfully managing innovations.* - 2nd ed. 2014 - Wiesbaden : Gabler Verlag, 2014. • Further literature as required **Innovation/Research Project Realization:** • - Bland, D. J., Osterwalder, A., Smith, A., & Papadakos, T. (2020). *Testing business ideas*: Wiley: Hoboken. • Engeln, Werner (2006): *Methods of product development*. Munich : Oldenbourg-Industrieverlag.

	• Schwarz, Erich J.; Dummer, Rita; Krajger, Ines (2007): *From the business idea to market success*. Vienna : Linde Verlag • Subject-specific literature depending on the respective project work.
Workload	Workload: 9 ECTS x 30 hours = 270 hours. Innovation/Research Project Concept: 3 ECTS Innovation/Research Project Realization: 6 ECTS Attendance time: 6 SWS x 15 weeks = 90 hours or attendance time in consultation with supervisor / project- leader
Media forms	Depending on the respective project work / supervisor: PowerPoint, reprints, interactive group tasks, physical or IT-based prototypes, interactive teaching discussion, research work (library).

5. Compulsory Elective Subjects "Focus"

Subjects amounting to 9 ECTS must be selected from the Master's courses offered by the WI department and/or other departments/faculties of the university in consultation with the head of the study program and the respective lecturer. Subjects are to be reported to the Examinations Office via a list or, if necessary, individually via a form.

Individual courses can be combined individually as well as entire elective modules. There is no entitlement to freedom from overlaps. A list of the possible elective subjects and modules in the study program can be viewed at the program management assistant’s office.

"Wahlpflichtfächer "Fokus"" / "Electives "Focus""	
Code number	MWI10023
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	9
SWS	6
Associated courses	MWI10024 Focus A MWI10025 Focus B MWI10026 Focus C
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Technical and organizational questions, especially for Master's courses that are not offered by the WI department, must be clarified in advance with the lecturer.
Type(s) of examination, duration (only for PLK/PLM)	In each case PLH/PLK/PLP/PLR (duration of exam according to the elective list)
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	The respective lecturers of the selected Master's courses on the elective list.
Assignment to the curriculum	MIM, MEM - Compulsory Elective Subject 1st/2nd semester
Teaching forms of the courses of the module	, Seminar-style teaching, lecture or project depending on the courses chosen.
Goals	Students acquire additional, in-depth knowledge within the framework of specialization subjects of their choice. The wide range of Master's courses offered by Pforzheim University gives students the opportunity to set individual priorities.
Interdisciplinary qualification goals	Depending on the selected courses
Contents	These depend on the courses selected from the elective list. Courses can be chosen from the Master's courses offered by all 3 faculties of the university in consultation with the head of the study program and the respective lecturer. The selectable subjects are placed in a list (elective list). Courses can be combined individually or taken as complete elective modules. There is no entitlement to admission or freedom from overlaps.
Literature	This depends on the courses selected from the elective list.
Workload	Workload: 9 ECTS x 30 hours = 270 hours. Attendance time: 6 SWS x 15 weeks = 90 hours attendance time

Media forms	Depending on the selected courses.

6. Major Industrial Management I

"Major Industrial Management I"	
Code number	MWI10045
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10046 Seminar Industrial Management A MWI10047 Seminar Industrial Management B
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	Each PLH/PLK/PLP/PLR (60 minutes)
Teaching language	Seminar Industrial Management A: English Seminar Industrial Management B: German or English
Person responsible for the module	Prof. Dr. Ansgar Kühn
Teachers	Seminar Industrial Management A: N.N. Seminar Industrial Management B: N.N.
Assignment to the curriculum	MIM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Seminar/lecture/workshop
Goals	Students acquire in-depth knowledge and skills to enable effective management in industrial organizations. To this end, the module teaches both theoretical principles and practical application to enable students to take on various management tasks in a complex, technical environment. In particular, students learn about the special requirements of selected complex and interdisciplinary issues and are able to design convincing solutions. Where possible, the design of the module should take appropriate account of the students' initial qualifications and thus enable specific knowledge acquisition.
Interdisciplinary qualification goals	The module strengthens the ability for critical reflection and problem solving as well as interdisciplinary skills.
Contents	Industrial Management covers a wide range of topics. In addition to the topics covered in other modules, additional topics can be specifically included or deepened in the Industrial Management I major. This includes, among other things • Strategy and organization: aspects of organizational and operational structure, industry, competition and market analysis, strategy development and strategic planning • Operations Management: Principles and tools for the effective management of industrial operations processes. This includes process improvement, supply chain management, quality control and productivity improvement methods. • HR management: Management of HR in an industrial environment in all aspects along the HR lifecycle

	• Financial management: particular importance of decision-making and resource allocation, analysis, budgeting, controlling, investment decisions, risk assessment. • Sustainability & resilience: Integration of sustainable and environmentally friendly working methods and processes in manufacturing companies. CSR, sustainable and resilient supply chains, energy management, circular economy, green manufacturing
Literature	Will be announced by the lecturer.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Powerpoint, flipchart, practical presentation

7a. Major Engineering

One of the modules 7a, 7b or 7c must be completed in accordance with the certified entry qualification:

- 7a for students without a relevant technical Bachelor's degree;
- 7b for students with a technical Bachelor's degree;
- 7c for students who provide evidence of both technical and business entry qualifications from the Bachelor's study course, e.g. subjects amounting to 6 ECTS must be taken here in line with the WI qualification framework.

The choice between 7a/7b/7c is made after individual examination by the head of the study program within the framework of a binding study agreement.

"Major Engineering"	
Code number	MWI10060
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	3
SWS	2
Associated courses	MWI10049 Engineering Basics
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	PLH/PLK/PLP/PLR (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Dr. Ansgar Kühn
Teachers	Engineering Basics: Prof. Dr. Kai Oßwald
Assignment to the curriculum	MIM - compulsory subject 1st semester
Teaching forms of the courses of the module	Seminar-style lecture with practical exercises
Goals	• Teaching the basics of technical communication • Practicing engineering arithmetic • Introduction to basic engineering subjects
Interdisciplinary qualification goals	The module teaches the most essential technical basics for students with little or no previous technical training. This creates the prerequisites for the technical subjects of study program.

Contents	**Engineering basics:**
	• Basics (1 unit)
	  ○ Calculations
	  ▪ Basics
	  ▪ Examples
	  ▪ Fermi problems
	  ○ Units
	• Technical drawing (2 units)
	  ○ descriptive geometry, projections, views
	  ○ Thread, dimensions
	  ○ Exercises
	• Technical mechanics (3 units)
	  ○ Forces and torques (central and general force systems)
	  ○ Tension and strength
	• Materials science (4 units)

	○ Metals: lattice, crystallites, dislocations, iron-carbon diagram ○ Fundamentals of polymers ▪ Origin and behavior ▪ Basic manufacturing processes • Electrical engineering (4 units) ○ Direct current ▪ Resistance, Kirchhoff's rules ○ Alternating current ▪ Transformers ○ Three-phase current ○ Power, energy ○ Digital technology ○ Calculating with electrical quantities
Literature	OBERG, Erik. *Machinery's Handbook, Toolbox & Calc Pro 2 Combo*. 2016.
Workload	Workload: 3 ECTS x 30 hours = 90 hours. Attendance time: 2 SWS x 15 weeks = 30 hrs.
Media forms	Slide presentations, video, blackboard notes

7b. Major Business

One of the modules 7a, 7b or 7c must be completed in accordance with the certified entry qualification:

- 7a for students without a relevant technical Bachelor's degree;
- 7b for students with a technical Bachelor's degree;
- 7c for students who provide evidence of both technical andbusiness entry qualifications from the Bachelor's study course, e.gsubjects amounting to 6 ECTS must be taken here in line with the WI qualification framework.

The choice of 7a/7b/7c is made after individual examination by the head of the study program within the framework of a binding study agreement.

"Major Business"	
Code number	MWI10062
Semester of study	1st semester
Level	Professionally qualifying academic level
Credits	3
SWS	2
Associated courses	MWI10051 Business Management
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	PLH/PLK/PLP/PLR (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Schnell
Teachers	Business Management: Prof. Schnell
Assignment to the curriculum	MIM - compulsory subject 1st semester
Teaching forms of the courses of the module	Seminar-based teaching including a business simulation workshop r
Goals	Students are taught how business people think and act using a business simulation in the form of a workshop-style seminar. Students learn how to manage a company commercially and how to analyze and ensure effectiveness and efficiency within the company. Students learn how to use numerous business instruments such as market and SWOT analysis tools, product costing, cash flow calculation and the basics of accounting.
Interdisciplinary qualification goals	In addition to business expertise, which forms the core of teaching in this subject, other objectives and requirements for action that compete with business activity are discussed with the students. This promotes ethical awareness in business enterprises. Furthermore, students learn to think beyond departments and functional areas in complex companies and to communicate and collaborate with each other in a variety of ways within the company.
Contents	• Introduction to business management: Setting targets - developing markets - securing profitability - ensuring financing - monitoring targets with Bosch key figures • Business planning and budgeting (BP): Content, structure, process, parties involved

	• Analysis of the markets and alignment of the company to the market: market research and marketing • Capacity and financial planning in the company • Pricing and calculation: Basic principles of PPC (product costing) calculation at Bosch • Measurement of corporate target achievement with the help of Bosch-specific key figures, including EBIT, return on investment (ROI), break-even point, cockpit charts • Control of business development with the help of Bosch contribution margin accounting and the balance sheet
Literature	• Wöhe/Döring/Brösel: *Introduction to General Business Administration* - Vahlen-Verlag : Munich / latest edition • Wöhe/Kaiser/Döring: *Exercise book for the introduction to general business administration* - Vahlen-Verlag : Munich / latest edition
Workload	Workload: 3 ECTS x 30 hours = 180 hours. Attendance time: 2 SWS x 15 weeks = 60 hrs.
Media forms	Workshop using pin boards, flip charts and manual for business simulation plus a set of slides on the basic principles of business administration

7c. Major Industrial Management II

One of the modules 7a, 7b or 7c must be completed in accordance with the certified entry qualification:

- 7a for students without a relevant technical Bachelor's degree;
- 7b for students with a technical Bachelor's degree;
- 7c for students who provide evidence of both technical and business entry qualifications from the Bachelor's study course, e.g. subjects amounting to 6 ECTS must be taken here in line with the WI qualification framework.

The choice between 7a/7b/7c is made after individual examination by the head the study program within the framework of a binding study agreement.

"Major Industrial Management II"	
Code number	MWI10064
Semester of study	1st/2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10053 Focus D MWI10066 Focus E
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	Technical and organizational issues, especially for Master's courses that are not offered by the WI department, must be clarified in advance with the lecturer.
Type(s) of examination, duration (only for PLK/PLM)	In each case PLH/PLK/PLP/PLR (duration of exam according to the elective list)
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	The respective lecturers of the selected Master's courses on the elective list.
Assignment to the curriculum	MEM - Compulsory elective subject 1st/2nd semester
Teaching forms of the courses of the module	Seminar-style teaching, lecture or project depending on the courses chosen.
Goals	Students acquire additional, in-depth knowledge within the framework of specialization subjects of their choice. The wide range of Master's courses offered by Pforzheim University gives students the opportunity to set individual priorities.
Interdisciplinary qualification goals	Depending on the selected courses
Contents	These depend on the courses selected from the elective list. Courses can be chosen from the Master's courses offered by all 3 faculties of the university in consultation with the head of the study program and the respective lecturer. The selectable subjects are posted in a list (elective list). Courses can be combined individually or taken as complete elective modules. There is no entitlement to admission or freedom from overlaps.
Literature	This depends on the courses selected from the elective list.
Workload	Workload: 6 ECTS x 30 hours = 180 hours.

	Attendance time: 4 SWS x 15 weeks = 60 hours attendance time
Media forms	Depending on the selected courses.

8. Management of New Technologies

"Management neuer Technologien" / "Management of Emerging Technologies"	
Code number	MWI10016
Semester of study	2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10017 Technical Concepts MWI10018 Organizational Concepts
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	PLK/PLP (60 minutes)
Teaching language	English
Person responsible for the module	Prof. Dr. Kölmel
Teachers	Technical Concepts: Prof. Dr. Thomas Schuster Organizational Concepts: Prof. Dr. Kölmel
Assignment to the curriculum	MIM English Trackm, MEM - compulsory subject 2nd semester (MEM - compulsory subject 2nd semester)
Teaching forms of the courses of the module	Seminar-based teaching and exercises, intensive block course with follow-up dates. The course is designed to be interactive. Current practical examples illustrate the content. Project (exemplary implementation of a technical prototype).
Goals	The students • understand the importance of new technologies for the future of the economy, • can apply the basic concepts of emergent technology management, • can design and implement a technical prototype.
Interdisciplinary qualification goals	• Technological competence: Students should develop technological knowledge and understanding in order to recognize, evaluate and successfully introduce new technologies in companies. • Strategic thinking: Emphasis is placed on strategic thinking in order to recognize the potential of new technologies and integrate them into a holistic corporate strategy. • Interdisciplinary collaboration: The course promotes the ability to collaborate between different disciplines in order to master the complexity of new technologies and develop innovative solutions.
Contents	Competition for the development of new technologies is becoming increasingly fierce worldwide. At the same time, product life cycles are becoming shorter. The result: an "innovation race" in which it is important to recognize and seize technological options at an early stage. This is the only way to seize market opportunities and exploit important competitive advantages. This raises the question for companies of how to recognize the potential of of new technologies in good time and how to use them as efficiently and effectively as possible. These are key issues in the management of new technologies.

	The course provides an overview of the international development of key new technologies, introduces important methods of technology management and discusses the technical, economic and social significance of emerging technologies. Basic concepts of technology management are introduced and the management of new technologies is deepened using case studies. If you look at the emerging digital business models, you will notice certain similarities in many of their architectures. Cloud services are often used to provide the basis for complete networking. The cloud services provide certain services that generate added value for the end user. Large amounts of data and data streams are generated by many sensors and data streaming when using IoT (Internet of Things). With IoT, however, cloud services are not limited to the storage of "streamed" mass data from sensors and smart objects, but only generate added value for the end user through the processing and provision of further information - e.g. in the context of predictive analytics and control of actuators. Exemplary prototypes are implemented as part of a project.
Literature	• Schilling, M. A. (2012): *Strategic Management of Technological Innovation.* 4th ed., McGraw-Hill Education. • Schuh, G., Klappert, S. (2011): *Technologiemanagement - Handbuch Produktion und Management 2.* 2nd ed., Springer: Heidelberg. • Wördenweber, W. (2008): *Technology and Innovation Management.* 3rd ed., Springer: Heidelberg. • Wilder, B. (2012): *Cloud Architecture Patterns.* O'Reilly and Associates. • Provost, F., Fawcett, T. (2013): *Data Science for Business: What you need to know about data mining and data-analytic thinking.* O'Reilly and Associates.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs. Including 30 hours of concept and method teaching and 30 hours of use of methods and presentation of emergent concepts. 120 hours of project development and elaboration as well as preparation of the final presentation
Media forms	Slides, flipchart, videos, active board, university e-learning platform.

9. Cross Border Cooperation

"Cross Border Cooperation"	
Code number	MWI10019
Semester of study	2nd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	None
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	PLP
Teaching language	English
Person responsible for the module	Prof. Dr. Kühn
Teachers	Prof. Dr. Kühn
Assignment to the curriculum	MIM English Track, MEM - compulsory subject 2nd semester
Teaching forms of the courses of the module	Seminar-based teaching/project work in cooperation with a company, in combination with an excursion abroad
Goals	Globalization has significantly changed both the market environment and the corporate structures of companies. Companies expect global competition to intensify further and have to face the major challenges of a globalized world: Tapping into new foreign markets, establishing and expanding foreign production sites, but also constantly growing cost pressure. The highly dynamic nature of the changing business environment and international cooperation require new structures and place new demands on management. As a consequence, international management, a better understanding of intercultural aspects and cooperation with foreign colleagues and partners as well as the cross-border management of employees are becoming increasingly important and are becoming more and more important in management training and the professional practice of internationally active managers. The aim of the course is to provide students with a better understanding and appropriate preparation for future management tasks. This includes: • A good understanding of how different cultures influence cooperation in international projects. • Management of interdisciplinary and international projects: o Expansion of problem-solving skills o Acquiring knowledge through "experimental learning" o Communication within the team and understanding the dynamics o Achieve outstanding results both in writing and in the final presentation to the project sponsor.
Interdisciplinary qualification goals	The module contributes to an understanding of other countries/company cultures. By combining it with an excursion/project work on site, the sense of togetherness as well as group identity and the ability to work together are significantly promoted.

Contents	Real case studies (usually in cooperation with companies) are worked on by international project teams. The aim is to promote both the professional and personal development of students in the following areas. • Global internationalization strategies • Operational topics related to cross-border/international business activities: organizational development in an international context, international human resources management, marketing and sales, global sourcing, global supply chain management, operations management • International and intercultural management • Recognizing and coping with complex intercultural situations and effective leadership in intercultural teams. The course is held in cooperation with annually changing partners (companies or universities) in neighbouring countries. As part of the seminar, students work in project groups on real problems posed by companies. The seminar includes both face-to-face events in Germany and abroad as well as autonomous project work by the teams (self-organization by the project teams). Interaction with company representatives as well as interim and final presentations are planned.
Literature	• Dülfer, E. (2011): *International management in different cultural areas.* Oldenbourg: Munich and others. • Hill, C. (2013): *International Business - competing in the global marketplace.* McGraw-Hill: New York. • Hofstede, G., Hofstede, G. J. (2010): *Culture and organizations - Software of the mind.* McGraw-Hill: New York et al. • Trompenaars, A., Hampden-Turner, C. (2011): *Riding the waves of culture - Understanding cultural diversity in business.* Brealey: London. • Depending on the real case studies, further special literature may be necessary. (this usually arises in the course of the project)
Workload	Workload: 6 ECTS x 30 hours = 180 hours. Attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Project work in small groups (approx. 4 to 6 people), which is carried out both virtually and during face-to-face events. The face-to-face events are supplemented by lectures as required, and the project work is supervised by appropriate individual project coaching for the subgroups.

10. Managing the Value Chain

"Managing the Value Chain"	
Code number	MWI10020
Semester of study	2nd semester
Level	Professionally qualifying academic level
Credits	3
SWS	2
Associated courses	MWI10022 Strategic Purchasing
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	English B2
Type(s) of examination, duration (only for PLK/PLM)	PLH/PLR/PLP
Teaching language	English
Responsible for the module	Prof. Dr. Peter
Teachers	Prof. Dr. Peter
Assignment to the curriculum	MIM English Track - compulsory subject 2nd semester, MEM - compulsory subject 1st/2nd semester
Teaching forms of the courses of the module	Lecture and seminar-style teaching
Goals	Students know • the basics, concepts and methods of corporate procurement, • the strategic procurement process, • the main challenges in international procurement, • Develop, optimize and implement purchasing strategies • Evaluate and select suppliers, • negotiate key contractual elements.
Interdisciplinary qualification goals	The module promotes thinking in terms of processes and workflows and helps to view, analyze, map and improve end-to-end processes from suppliers to customers from different perspectives.
Contents	Procurement marketing, procurement market research, procurement strategies in an international environment, supplier development, analysis of technical products with regard to make or buy.
Literature	• Chopra, S. (2018): *Supply Chain Management: Strategy, Planning and Operation.* 7th Edition, Pearson: London. • Heizer, J., Render, B. (2016): *Operations Management.* Global Edition, 11th Edition, Pearson: London. • Van Weele, A. J. (2014): *Purchasing and Supply Chain Management.* 6th Edition, Cengage Learning: London. • Handfield, R. B., Monczka, R. M., Giunipero, L. C., Patterson, J. L. (2016): *Sourcing and Supply Chain Management.* 6th Edition, Cengage Learning: Florence, KY. • Lecture notes of the lecturer
Workload	Workload: 3 ECTS x 30 hours = 90 hours. of which total attendance time: 2 SWS x 15 weeks = 30 hrs.
Media forms	Slides, flipchart, projector, interactive board, university e-learning platform (Moodle), computer pool, sample machine for learning on the technical object.

11. Capstone

"Capstone"	
Code number	MWI10027
Semester of study	3rd semester
Level	Professionally qualifying academic level
Credits	6
SWS	4
Associated courses	MWI10028 Capstone Seminar COL6996 Scientific colloquium
Participation requirements according to SPO	Admission to the Master's program
Recommended prerequisites	In-depth knowledge through successful completion of the lectures from all areas of the MEM curriculum.
Type(s) of examination, duration (only for PLK/PLM)	Capstone Seminar: PLH/PLR/PLP Scientific colloquium: UPL
Teaching language	German or English
Person responsible for the module	Prof. Dr. Kühn
Teachers	Capstone Seminar: Alternating lecturers from the field of industrial engineering Subject-specific colloquium: Examiners can be all full-time professors.
Assignment to the curriculum	MEM, MIM - compulsory subject 3rd semester
Teaching forms of the courses of the module	Project work, seminar, case study seminar, individual performance, preferably in cooperation with companies
Goals	**Capstone Seminar:** The MEM curriculum aims to provide students with a consecutive and generalist education, combined with the students' individual areas of interest and development goals. The latter are achieved through the selection of elective subjects and, under certain circumstances, courses at partner universities abroad. At the end of their studies, all students should apply and deepen the breadth of their acquired knowledge and skills as part of the capstone seminar and work out the interdependencies between the individual subject areas. **Scientific colloquium:** Within the framework of individual achievements, students should set individual, subject-specific priorities or reduce identified weaknesses. Aspects of individual career planning are given special consideration. The ability for critical self-reflection is encouraged.
Interdisciplinary Qualification goals	The module contributes to teamwork and (self-)reflection skills.
Contents	**CapstoneSeminar:** The seminar is organized by the supervising professors depending on the number of participants and the topics to be dealt with. Project work and/or case study seminars are used for this purpose. The topics as well as the timing and proportion of attendance phases are determined at an early stage. **Scientific colloquium:** The content depends on the individual student. In particular, aspects of academic or professional qualifications, e.g. additional qualifications that go beyond the curriculum, should be taken

	into account here. Key topics are determined in consultation with the supervising professors.
Literature	Will be announced in good time.
Workload	Workload: 6 ECTS x 30 hours = 180 hours. of which attendance time: 4 SWS x 15 weeks = 60 hrs.
Media forms	Seminar / project or interactive teaching discussion

12. Master's thesis

"Master's thesis"	
Code number	THE6880
Semester of study	3rd semester
Level	Expert level
Credits	24
SWS	0
Associated courses	None
Participation requirements according to SPO	The Master's thesis can be submitted in the 2nd semester at the earliest.
Recommended prerequisites	Solid technical and scientific knowledge from the Master's program.
Type(s) of examination, duration of examination (only for PLK/PLM)	PLT
Teaching language	German or English
Person responsible for the module	Responsible professor
Teachers	All professors in the department.
Assignment to the curriculum	MEM, MIM - compulsory subject 3rd semester
Teaching forms of the courses of the module	Thesis
Goals	The Master's thesis should demonstrate that students are able to work independently on an industrial engineering problem using scientific methods and solve it precisely and efficiently within a specified period of time. They are able to research available scientific findings and develop their own theoretical concepts and models. They are proficient in the methods and procedures required for this. They select suitable methods and apply them correctly, adapt them, develop them further and check their viability when dealing with complex problems.
Interdisciplinary qualification goals	Students are able to present complex topics in a differentiated manner from various perspectives and prepare them according to academic standards. They demonstrate their sound analytical thinking skills and critical judgment using scientific methods in their thesis. They are able to plan and carry out an academic thesis project over a longer period of time and demonstrate their resilitence in doing so. Students also demonstrate that they can formulate their results clearly and write them down in an academically appropriate form. Students are able to critically compare their own results with other approaches, evaluate their own results and thus make a significant contribution to the scientific field or provide a solution with high practical relevance.
Contents	As a rule, a topic belonging to the faculty's main research areas is given to the students to work on or alternatively proposed by the students. In terms of subject content, it must be assigned to the field of economics and/or engineering and cover current subject-specific or interdisciplinary issues and topics.

	Students independently research the available scientific findings, carry out their own analyses and formulate theses. They also carry out their own empirical or theoretical research in order to achieve the objectives of the Master's thesis. To this end, they develop their own theories and models, which they verify or refute from a scientific point of view.
Literature	Topic-specific literature, to be chosen by the students.
Workload	Processing time 6 months, 24 ECTS x 30 hours = 720 hours of work including documentation.
Media forms	Printed and electronic copies.