HECTOR SCHOOL
Technology Business School of the KIT

Karlsruher Institut für Technologie

Course Guide Book Intake 2020/2021

Executive Master Program
Information Systems Engineering and Management

Contents

Contact & Imprint

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Curriculum may be subject to change.

1 Foreword

Information Systems Engineering and Management

»We are living in a digital world. Rapidly evolving information technologies drive the digital transformation of products, services, and organizations. Successful enablers of digital transformation require a profound understanding and integration of business and information technology. «
Prof. Dr. Alexander Mädche

During the last decades, we witnessed a growing importance of information technology (IT) in business and society alongside in increasing speed of innovation cycles. IT has become core for businesses from an operational company-internal and external customer perspective. Today, companies have to rethink their way of doing business. Digital products and services will characterize tomorrow's world and organizations are digitally transformed across all functional areas. Capturing the emerging opportunities requires globally thinking visionaries and managers, who are able to combine profound competence in information technology with excellent know-how in management.

The Master Program Information Systems Engineering & Management (ISEM) qualifies graduates to drive digital transformation of products, services, and organizations from a business and IT perspective. Graduates encounter digitalization challenges with an engineering orientation and solve them with the help of modern management methods. They are also in a position to make efficient and effective use of information technologies within organizations following a socio-technical paradigm. Competitive and innovative digital products and services are developed and optimized to successfully accompany and direct digital changes in organizations and business networks.

The program empowers graduates to apply an interdisciplinary approach to problems and trains adequate solution with a systems-oriented mindset. From an engineering perspective, graduates understand the role and potential of digital platforms from an enterprise and market point of view including state-of-the-art technologies such as Internet-of-Things and Blockchain. They know modern software and system engineering techniques with a specific emphasis on the cloud computing paradigm. ISEM graduates can design and optimize business processes following a top-down and bottom-up approach. They also know how to transform (big) data to actionable knowledge following an engineering approach. These competencies are enriched with security and privacy engineering concepts and technologies complemented with real-world cases on critical infrastructure management. Finally, ISEM graduates can specialize in digital services or autonomous robotics. In the respective specialization modules, they collect deep knowledge in one of the two fields.

In addition to the engineering expertise, ISEM graduates share five management modules with other master programs at HECTOR School. This fosters interdisciplinary networking across industries and provides the participants with state-of-the-art business knowledge in strategy, finance, accounting, marketing, innovation management, project management, decision and risk management and human resource management. Therefore, they can consider the commercial implications of technology-centric decisions and develop a holistic view on business and IT.

Prof. Dr. Alexander Mädche

Program Director of Information Systems Engineering and Management

2 Program Directors

Title/ Name	Prof. Dr. Alexander Mädche	
Phone	+49 (0) 721-608 41580	
E-Mail	***Alexander.Maedche@kit.edu***	
Affiliation	Institute of Information Systems and Marketing, KIT	
Current Position	Dean of Studies "Information engineering and Management", KIT	
Vita	1999 PhD at Universität Karlsruhe (TH) 2001 Department Manager FZI 2003 Bosch Group, Department Manager 2006 SAP SE 2009 University Mannheim, Full Professor 2015 KIT, Full Professor Information Systems and Service Design	
Fields of Interest	Interactive Intelligent Systems Information Systems Engineering Usability and User Experience Engineering Business Intelligence & Analytics Systems	
Memberships & Awards	▪ Herbert A. Simon Award for the Best Design Research Paper of the DESRIST 2013 Conference ▪ Best Paper Award for the Best Research Paper of the DESRIST 2015 Conference ▪ German Association for Computer Science (Gesellschaft für Informatik – GI) ▪ German Usability Professionals Association (UPA) ▪ International Software Product Management Association (ISPMA) ▪ Association for Information Systems (AIS) ▪ German University Association (Deutscher Hochschulverband – DHV) ▪ Usability in Germany e.V.	

Title/ Name	Prof. Dr. rer. nat. Andreas Oberweis	
Phone	+49 (0) 721-608 44516	
E-Mail	***Oberweis@kit.edu***	
Affiliation	Institute of Applied Informatics and Formal Description Methods, KIT	
Current Position	Chair: Business Information Systems, KIT	
Vita	1990 PH.D. (Dr. rer.nat.) Universität Mannheim 1995 Doctorate of Science (Habilitation) Universität Karlsruhe (TH) 1995 Appointed Full Professor Goethe Universität Frankfurt 2003 Appointed Full Professor Universität Karlsruhe (TH) Board Member EUCIP	
Fields of Interest	▪ Distributed Systems ▪ Information Systems Modeling ▪ E-Collaboration ▪ E-Learning	

	▪ Document Management
Memberships & Awards	▪ Gesellschaft für Informatik ▪ GMDS ▪ ACM ▪ IEEE Computer Society

Title/ Name	Prof. Dr. Martin E. Ruckes
Phone	+49 (0) 721-608 43427
E-Mail	***Martin.Ruckes@kit.edu***

Affiliation	Co-head of Institute of Finance, Banking, and Insurance, KIT
Current Position	Co-head of Institute of Finance, Banking, and Insurance, KIT
Vita	▪ Assistant Professor of Finance, Dept. of Finance, School of Business, University of Wisconsin Madison, 2000-2007 ▪ Research Associate, Dept. of Economics, University of Mannheim, 1998-1999 ▪ Research Fellow, Dept. of Economics, University of Mannheim, 1997-1998 ▪ Lecturer, Dept. of Finance, School of Business, University of Wisconsin-Madison, 1997 ▪ Visiting Scholar, Dept. of Economics, Boston University, 1996 ▪ Visiting Researcher, Dept. of Economics, Université Libre de Bruxelles, 1996 ▪ Member of DFG Graduiertenkolleg “Allokation auf Finanz- und Gütermärkten”, University of Mannheim
Fields of Interest	▪ Primary fields: Corporate Investment, Corporate Finance, Economics of Organizations, Banking ▪ Secondary fields: Contract Theory, Industrial Organization
Memberships & Awards	▪ Research grant (“On the Structure of the Modern Financial System”), BBBank, 2009 ▪ Research grant (“Managerial Entrenchment and Corporate Investment”), Graduate School of the University of Wisconsin-Madison, 2006 ▪ Research grant (“Coordination Risk in Lending and the Capital Structure of Arbitrageurs”), Graduate School of the University of Wisconsin-Madison, 2005 ▪ Research grant (“Arbitraging Arbitrageurs”), Graduate School of the University of Wisconsin-Madison, 2003 ▪ Research grant (for research visit at Boston University), German Academic Exchange Service, 1996-1997 ▪ Scholarship (for participating in the Ph.D. program at the University of Mannheim), German Science Foundation, 1994-1996 ▪ Research grant (for research visit at the Université Libre de Bruxelles), Erasmus Exchange Program, 1996

3 Study Plan

3.1 Overall Program Objectives and Qualification Targets

All six executive master programs of the HECTOR School of KIT have the following qualification objectives in common:

1. Enabling the graduates to operate in an analytical and scientifically sound way
2. Enabling the graduates to independently apply and further develop methods and technologies in the areas of research and development
3. Enabling the graduates to perform successful, self-dependent, and innovative work which is related to their occupational fields in their respective areas of the specialization
4. Enabling the graduates to work on complex topics in the pursued specialization
5. Enabling the graduates to apply methods both in economic and in management-related issues
6. Enabling the graduates to assume leadership positions in the field of their chosen specialization, also in international contexts

3.2 Qualification Objectives for Information Systems Engineering and Management

The specific qualification objectives for the executive master program ISEM are the following:

The Master Program Information Systems Engineering & Management qualifies graduates to drive internal and external digitalization from a business and IT perspective.

Graduates

- encounter digitalization challenges with an **engineering orientation**
- solve them with the help of **management methods**.
- build up **specialized knowledge** in digital services or autonomous robotics

3.3 Program Structure and Curriculum

Excellence in Technology Management: Six Executive Master Programs are offered by the HECTOR School of Engineering and Management. The school – named after Dr. h.c. Hans-Werner Hector, the co-founder of the software company SAP – is run in cooperation with four University Departments of the KIT. The programs are offered in:

- Energy Engineering and Management (EEM)
- Financial Engineering (FE)
- Information Systems Engineering and Management (ISEM)

- Management of Product Development (MPD)
- Mobility Systems Engineering and Management (MSEM)
- Production and Operations Management (POM)

The concurrently taught Executive Master Program is designed for working professionals. Block lectures scheduled at intervals allow participants to continue with demanding careers while acquiring new skills. The lectures are scheduled to take place over a period of 15 months. Courses are divided into 10 intensive modules of 14 days each following a timetable of monthly intervals. Each participant will take the same sequence of courses throughout the program. The two-week block lectures allow a complete immersion into the academic environment without long interruption of existing work-related responsibilities. The program officially begins in October of each year and is completed with a Master Thesis.

Semester	Subject	Type of Module	Name of Module	Course	Credits
1	Management	MM1	Marketing and Information	1. Designing and Selling Solutions (incl. Negotiation Training)	6
				2. Information Systems Management	
				3. Big Data Methods	
				4. Legal Aspects of Information	
	Engineering	EM1	Digital Platforms	1. Enterprise Systems	8
				2. IoT Technologies & Platforms	
				3. Platform & Market Engineering	
	Engineering	EM2	Software Engineering	1. Software and Systems Engineering	8
				2. Advanced Web Applications	
				3. Cloud Computing	
	Management	MM2	Finance and Value	1. Management Accounting	6
				2. Financial Accounting	
				3. Strategic Financial Management	
				4. Case Studies	
2	Management	MM3	Decisions and Risk	1. Decision Modeling	6
				2. Risk Aware Decisions	
				3. Interactive Decisions	
				4. Robust and Stochastic Optimization	
	Engineering	EM3	Process and Knowledge Engineering	1. Business Process Engineering	8
				2. Process Mining	

Semester	Subject	Type of Module	Name of Module	Course	Credits
				3. Data and Knowledge Management	
				4. Big Data Management	
	Engineering	EM4	Security and Privacy Engineering	1. Information Security	8
				2. Applied Cryptography	
				3. Network Security	
				4. Data Protection Regulations	
				5. Emerging Technologies & Critical Information Infrastructures	
	Management	MM4	Innovation and Projects	1. Technology Driven Innovation	6
				2. International Intellectual Property Law	
				3. Project Management	
				4. Multi-Project Management in an International Setting	
3	Engineering (elective)	EM5 - 1	Digital Services	1. Service Innovation	8
				2. Service Design Thinking	
				3. Digital Service Business Models and Transformation	
				4. Artificial Intelligence in Service Systems	
		EM5 - 2	Autonomous Robotics	1. Autonomous Robotics Lab	8
	Management	MM5	Strategy and People	1. Strategic Management	6
				2. Managerial Economics	
				3. Business Organization and Corporate Law	
				4. Strategic Human Resource Management	
				5. Leadership and Conflict Management	
		Thesis	Master Thesis (maximum 6 months)		20

Tab. 3-1 Study Plan ISEM

3.4 Academic Calendar Intake 2020

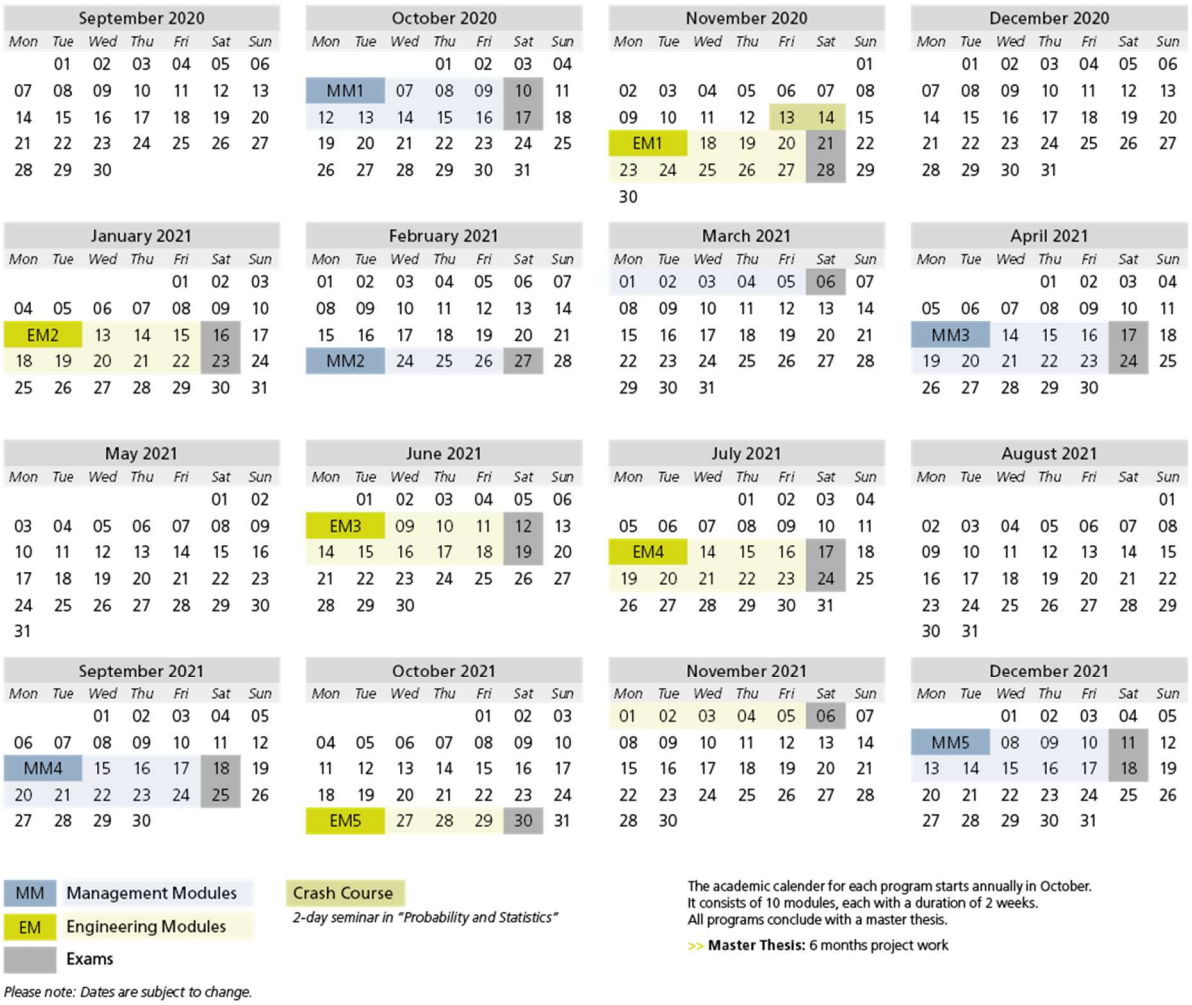

Figure 1: Academic Calendar Intake 2020

Selection of Elective Focus Area in Engineering Subject (SPO §19, par. 3)

There are two elective focus areas offered both within the subject of Engineering: **Digital Services** and **Autonomous Robotics**. The Management Modules and the Engineering Modules EM1, EM2, EM3 and EM4 are independent from the selection of the elective focus area and are identical for all students. The elective focus area **Digital Services** comprises the modules EM5 "Digital Services", whereas the elective focus area **Autonomous Robotics** contains the module EM5 "Autonomous Robotics". Students must select their elective focus area bindingly by January 25th, 2021. Therefore, students submit the linked form to the HECTOR School Administration Office.

3.5 Teaching Structure

Our programs are more than typical MBA programs. The primary goal is to enable young professionals to take a holistic approach when managing highly interdependent processes. Leadership for engineers in today's fast changing and complex environment does imply technological and organizational responsibilities and requires economical accountability and human resource management know-how. Therefore, all programs are based on 5 Management Modules where the participants are provided with general knowledge in finance, accounting, marketing, multi-project management and international law so they can consider commercial consequences of business decisions.

The engineering emphasis of each Master Program is laid on 5 additional Modules adapted to each specialization. The lectures in the Masters-specific field provide insight into the newest research topics. They convey current and state of the art methodology necessary to master the scope of innovative technologies. These engineering lectures also comprise the theoretical background necessary to model and analyze key decision problems in manufacturing sites.

Workshops and case studies allow ample opportunity to explore the direct applications of the modules simulating the real business environment. The programs conclude with a Master Thesis which allows the participants to work on a research project reflecting their own company's needs and its specific business environment. The final title bestowed after having successfully completed the programs is the M.Sc. of the Karlsruhe Institute of Technology (KIT).

3.6 Examination Structure

3.6.1 General Information

Examinations take place on both Saturdays during the module. Examinations can be written, oral or controls of success of another kind (e.g. a documentation of a case study). You may find the detailed information about the examination type in each lecture description. The examinations usually take place in rooms at the International Department. The exact location and dates will be communicated at the beginning of the module. Attendance in lecture is mandatory, strong participation is highly recommended. If students are unable to participate in the exam an official excuse (written) must be issued, prior to exam start.

3.6.2 Examination Process

Each student must show his identification card at exam start. The results of the exams are announced right after the examination if it is an oral exam and about four to six weeks after the examination if it is a written exam. The exam results can be find after each module on a transcript, which will be uploaded into a personal folder on HECTOR School SharePoint.

3.6.3 Exam Review

An exam review will be provided at the first Monday of the next module, where students may get an insight into the exams and have the opportunity to ask questions. There is no possibility to contest the exam if not attended the exam review. Participants need to bring their Student ID to the exam review.

For further information, please see the General Study and Examination Regulations (see 8.4).

3.7 Lecturers

3.7.1 Management Modules

Name	Institute
Program Director	
Prof. Dr. Martin E. Ruckes	Institute for Finance, Banking and Insurance, KIT
Module Supervisors	
Prof. Dr. Martin Klarmann	Institute of Information Systems and Marketing, KIT
Prof. Dr. Stefan Nickel	Institute of Operations Research, KIT
Prof. Dr. Petra Nieken	Institute of Management, KIT
Prof. Dr. Martin E. Ruckes	Institute for Finance, Banking and Insurance, KIT
Prof. Dr. Orestis Terzidis	Institute for Entrepreneurship, Technology Management and Innovation
Lecturers in Alphabetical Order	
Dr. Abilio Avila	Institute for Entrepreneurship, Technology Management and Innovation, KIT
Prof. Dr. Kerstin Fehre	Vlerick Business School
Prof. Dr. Oliver Grothe	Institute for Operations Research, KIT
Dr.-Ing. Iris Heckmann	FZI Forschungszentrum Informatik
Sven Jacobs	Norton Rose Fulbright LLP
Prof. Dr. Anja Kern	Cooperative State University, DHBW Mosbach
Dr.-Ing. Tobias Kunkel	Institute of Human and Industrial Engineering (ifab), KIT
Dr.-Ing. Robert Landwehr	Daimler AG
Gerald Oerter	Focus Sales, Consulting Gerald Oerter
Prof. Dr. Clemens Puppe	Institute of Economics, KIT
Prof. Dr. Steffen Rebennack	Institute of Operations Research, KIT
Prof. Dr. Martin Schulz	German Graduate School of Management and Law
Dr. Marcel Sinske	Institute of Operations Research, KIT
Prof. Dr. Indra Spiecker gen. Döhmann	Department of Law, Goethe Universität Frankfurt am Main
Dr. Jan-Oliver Strych	Institute for Finance, Banking and Insurance, KIT

3.7.2 Engineering Modules

Name	Institute
Program Directors	
Prof. Dr. Alexander Mädche	Institute of Information Systems and Marketing (IISM), KIT
Prof. Dr. Andreas Oberweis	Institute of Applied Informatics and Formal Description Methods, KIT
Module Supervisors	
Prof. Dr.-Ing. Kai Furmans	Institute for Material Handling and Logistics, KIT
Prof. Dr. Alexander Mädche	Institute of Information Systems and Marketing (IISM), KIT
Prof. Dr. Andreas Oberweis	Institute of Applied Informatics and Formal Description Methods, KIT
Prof. Dr. Ralf H. Reussner	Institute for Program Structures and Data Organization, KIT
Prof. Dr. Gerhard Satzger	Karlsruhe Service Research Institute (KSRI), KIT
Currently under revision	
Lecturers in Alphabetical Order	
Dr. Patricia Arias Cabarcos	Chair of IT Security, KIT
PD Dr. Roland Bless	Institute of Telematics, KIT
Prof. Dr. jur. Franziska Boehm	Institute for Project Defaults, KIT
M. Sc. Jonathan Dziedzitz	Institute for Material Handling and Logistics, KIT
Dr. Niels Feldmann	Karlsruhe Service Research Institute (KSRI), KIT
Prof. Dr. Björn Hein	Hochschule Karlsruhe- Technik und Wirtschaft
Dr. Robert Heinrich	Institute for Program Structures and Data Organization, KIT
M. Sc. Patric Hopfgarten	Institute for Material Handling and Logistics, KIT
Dr.-Ing. Niklas Kühl	Karlsruhe Service Research Institute (KSRI), KIT
Prof. Dr. Kay Mitusch	Institute for Economic Policy Research, KIT
Prof. Dr. Jörn Müller-Quade	Institute for Cryptography and Security, KIT
Prof. Dr. Clemens Puppe	Institute of Economic Theory and Statistics, KIT
Prof. Dr. Gerhard Satzger	Karlsruhe Service Research Institute, KIT
Dr. Ronny Schüritz	Karlsruhe Service Research Institute (KSRI), KIT
Prof. Dr. Thorsten Strufe	Chair of IT Security, KIT
Prof. Dr. Ali Sunyaev	Institute of Applied Informatics and Formal Description Methods, KIT
Dr. Ljiljana Stojanovic	Fraunhofer IOSB
Prof. Dr. Walter Tichy	Institute for Program Structures and Data Organization, KIT
Dr.-Ing. Andreas Trenkle	Institute for Material Handling and Logistics, KIT
Prof. Dr. York Sure-Vetter	Institute of Applied Informatics and Formal Description Methods, KIT
Prof. Dr. Christof Weinhardt	Institute of Information Systems and Management, KIT

Name	Institute
Prof. Dr. Christian Wurll	Hochschule Karlsruhe- Technik und Wirtschaft
Prof. Dr. Martina Zitterbart	Institute of Telematics, KIT

4 Description of the Management Modules

4.1 Marketing and Information

Module Name			
Marketing and Information			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Management	Prof. Dr. Martin Klarmann	6
Module Content			
Information becomes more and more important as a source of value creation for companies. This module looks at how information can be used to improve business performance in today's business environment. In the first week, the module looks at information-related topics in general, covering issues such as the implementation of information systems, the analysis of (big) data, and legal requirements surrounding the use of (customer) data in firms. In the second week, the module covers how to design and sell customer solutions. These hybrid offerings of products and services require careful analyses of customer information to work.			
Learning Results (LR)			
Participants will know: LR-1: How to set up effective information systems LR-2: Key issues surrounding the analysis of (big) data and machine learning LR-3: The boundaries to the use of information and data set by the legal environment LR-4: How to create value from information using customer solutions LR-5: How to empirically test hypotheses about sources of value creation using conjoint analysis			
Workload			
Total 180h, hereof 75h contact hours, 105h homework and self-studies (hereof 65 during module, 40 in preparation of module)			

Controls of Success In MM1 (4.1)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
4.1.1 Designing and Selling Solutions	Examination of another kind	Presentation of Case Study. Approx. 15 minutes per candidate	None	During course	Yes
4.1.2 Information Systems Management	Examination of another kind	Presentation of Case Study. Approx. 15 minutes per candidate	None	During course	Yes
4.1.3 Big Data Methods	Study Achievement	None	None	-	No

4.1.4 Legal Aspects of Information	Study Achievement	None	None	-	No
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

4.1.1 Designing and Selling Solutions

Course Name			
Designing and Selling Solutions			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Marketing and Information	Prof. Dr. Martin Klarmann Dr. Sven Feurer Gerald Oerter
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture	Total 90h, hereof 37,5h contact hours, 52,5h homework and self-studies	3

Overall Course Objectives

The course seeks to familiarize participants with the necessary techniques to design and sell solutions (i.e., hybrid offerings of services and products) that provide extra value to customers. These techniques are especially suited for markets where low-cost competitors from emerging markets offer products that are comparable in their performance to those of European manufacturers.

Learning Targets

Participants

- are able to develop customer value propositions for new offerings
- can set value-based prices
- can test hypotheses about what creates customer value using conjoint analysis
- are able to program simple online questionnaires
- are able to use Python to create experimental designs, analyze regression models, and produce simple visuals
- are prepared for price negotiations in B2B markets
- know the basic elements of customer-centric strategies

Course Content

- Value Creation (Monday)
- Solution Design (Tuesday)
- Value Appropriation (Wednesday)
- Negotiation for Value (Thursday)
- Customer Centricity (Friday)

Literature

Anderson, J., Kumar, N., & Narus, J. A. (2007). Value merchants: Demonstrating and documenting superior value in business markets.

Fader, P. (2012). Customer centricity: Focus on the right customers for strategic advantage. Wharton digital press.

Homburg, C., Schäfer, H., & Schneider, J. (2012). Sales excellence: Systematic sales management. Springer Science & Business Media.

Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2015). Value proposition design. Wiley.

Prerequisites for participation in course
No prerequisites
Modality of Exam
See 4.1

4.1.2 Information Systems Management

Course Name			
Information Systems Management			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Marketing and Information	Prof. Dr. Stefan Morana
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2

Overall Course Objectives
The primary objective of the course is to enable participants to understand the importance of the resource information in business and society as well as to manage information system from a socio-technical perspective. Thereby, participants of the course will be able to play a vital role at the intersection of technical and business issues, being able to bridge the gap between company's customers and end users, Line-of-Business experts and IT experts.
Learning Targets
Participants: ▪ understand the need for managing the resource information ▪ understand key concepts and implications of information systems (IS) ▪ get an overview on the different phases of the IS lifecycle ▪ know methods and techniques in order to successfully create value with IS.
Course Content

The course will cover the following topics ▪ Management of the resource information in organizations ▪ Introduction into the concept of IS from a socio-technical perspective ▪ Importance and special characteristics of the IS life cycle ▪ Methods and techniques for executing the pre-implementation, implementation, and post-implementation phases The lectures will be accompanied by hands-on exercises that will be used to review the presented material and enhance understanding.
Literature
Relevant literature will be distributed with the course materials.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 4.1

4.1.3 Big Data Methods

Course Name			
Big Data Methods			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Marketing and Information	Prof. Dr. Oliver Grothe
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture	Total 28,8h, hereof 12h contact hours, 16,8h homework and self-studies	0,96
Overall Course Objectives			
The primary objective of the course is to enable participants to understand the importance of limited information content in real data and implications for how precise we can learn from data. Furthermore, the students learn how to apply linear and slightly non-linear regression techniques using Python and also apply classification techniques.			
Learning Targets			
Participants: ▪ know what Big Data stands for. ▪ understand basic statistical concepts of statistical learning. ▪ have a first profound understanding of regression and classification techniques.			

▪ know and apply methods for the validation of results from data.
Course Content
The course will cover the following topics ▪ statistical inference ▪ statistical learning ▪ introduction to regression and classification techniques ▪ introduction to evaluation techniques The lectures will be completed by hands-on programming and data analysis exercises in Python that will be used to review the presented material and enhance understanding.
Literature
Relevant literature will be distributed with the course materials.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 4.1

4.1.4 Legal Aspects of Information

Course Name			
Legal Aspects of Information			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Marketing and Information	Prof. Dr. Indra Spiecker gen. Döhmann LL.M
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture	Total 25,5h, hereof 10,5h contact hours, 14,7h homework and self-studies	0,84
Overall Course Objectives			
The fundamental knowledge of the law governing the distribution of information supports participants in the adaptation of business strategies in today's digitalized business world. The participants will be enabled to identify and solve relevant problems from the areas of data and privacy protection in relation to business activities.			

Learning Targets
Participants ▪ Know relevant legal argumentation skills and the general structure of laws ▪ Know relevant principles and argumentations in data protection law, also in comparison with U.S. law ▪ Understand the difference between EU and national law and its implications for data protection law ▪ Are able to identify relevant legal problems in data protection law and solve small cases. ▪ Find and discuss different legal solutions on the basis of general legal argumentation skills to data protection law problems
Course Content
Managers and project leaders involved in the development, installment and management of digitalized products and services need a basic knowledge of data protection law in order to avoid costly decisions. This is even more important as the new EU-wide data protection regulation (GDPR) provides for heavy sanctions against privacy violators enforced by independent agencies and data subjects alike. The lecture deals with the basics of data protection law as structured within the EU: What are relevant data protection regulations? In what respect is (EU) law influencing the national regulatory systems? What are the core issues regulated within the EU-General Data Protection Regulation? What do businesses dealing in digitalized worlds have to be aware of? The lecture aims at a general understanding of the mechanisms of European data protection law with some excursions into U.S. law. Students will learn what to pay attention to when personal data is involved in business transactions. This knowledge, however, can only be rightly understood and applied, if students are aware of the general legal argumentation structures. Therefore, these will be dealt with, also.
Literature
▪ Simitis/Hornung/Spiecker gen. Döhmann (Eds.), Kommentar Datenschutzrecht, 2019 ▪ Tinnefeld/Buchner/Petri, Einführung in das Datenschutzrecht, 2017
Prerequisites for participation in course
Basic knowledge/practical experience in European Law as well as data protection law would be helpful but is not required
Modality of Exam
See 4.1

4.2 Finance and Value

Module Name			
Finance and Value			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Management	Prof. Dr. Martin E. Ruckes	6

Module Content

The module "Finance and Value" consists of three courses related to the creating of value in business environments: Management Accounting, Financial Accounting, and Strategic Financial Management. Applying the acquired knowledge in case studies round out the module.

The module shows how value is created in businesses by the careful quantitative assessment of the business environment and the identification of valuable opportunities, a thoughtful system of implementing business opportunities that coordinates activities by providing clear metrics for value creation, and the thorough understanding about how business decision translate into financial statements, often the firm's most important channel of communication to outside stakeholders.

Using the knowledge acquired in the courses in case studies reveals how to apply important business concepts to real world situations.

Learning Results (LR)

Participants

- are able to analyse business environments and to identify and finance value creating business opportunities,
- are in a position to implement business opportunities by designing an internal accounting system that coordinates the firm's business activities,
- understand how business decisions are communicated to outside stakeholders via a system of financial statements.

Workload

Total 180h, hereof 75h contact hours, 105h homework and self-studies (hereof 65 during module, 40 in preparation of module)

Controls of Success In MM2 (4.2)	Modality of Examination	Performance and Duration of Examination	Prerequisites for exam-participation	Examination Period	Graded
4.2.1 Management Accounting	Written examination	120 minutes	None	At the end of the module	Yes
4.2.2 Financial Accounting					
4.2.3 Strategic Financial Management					
4.2.4 Case Studies	Examination of another kind	Presentation of Case Study, Approx. 15 minutes per candidate	Written draft and	During course	Yes

			Presentation of Case Study		
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

4.2.1 Management Accounting

Course Name			
Management Accounting			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Finance and Value	Prof. Dr. Anja Kern
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8

Overall Course Objectives

Participants get an overview of accounting and controlling topics. They understand specific accounting and controlling topics, they are able to apply these to assignments and they are able to position these in the context of their own work.

Learning Targets

Participants gain an understanding of key concepts and techniques of management accounting, are able to use relevant costs for decision making, and are in the position to purposeful apply instruments for planning and control.

Course Content

Participants will learn about:

- Product costing concepts
- Cost allocation: between departments and from activities to products
- Job costing
- Process costing
- Short-term decision making, cost-volume-profit analysis
- Strategic investment decisions
- Budgeting and variance analysis
- Responsibility accounting
- Performance management

Literature

Cost Management by M. Wouters, F. Selto, R. Hilton, and M. Maher, 2012, McGraw-Hill Higher Education, ISBN-13 9780077132392

Prerequisites for participation in course
Knowledge about principles of financial accounting as well as discounting of future cash flows is desirable, but not obligatory required.
Modality of Exam
See 4.2

4.2.2 Financial Accounting

Course Name			
Financial Accounting			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Finance and Value	Dr. Jan-Oliver Strych
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8
Overall Course Objectives			
The course objective is to understand and critically assess financial statements. Participants know about the main principles and concepts of financial accounting used to prepare the balance sheet and income statement. Financial statements are analyzed to reveal profitability, identify cash flows and track the operating cycle.			
Learning Targets			
Participants are able to ▪ understand the balance sheet, income statement and statement of cash flow. ▪ track corporate decision-making into financial statements. ▪ apply financial statement analysis.			
Course Content			
This course provides participants with an understanding of the key financial statements and its underlying accounting principles. It is shown how investment and financing decisions affect the balance sheet and the income statement. Financial statement analysis is applied to measure a firm's liquidity, operational efficiency, and profitability.			
Literature			
Penman, S.H. (2013): Financial Statement Analysis and Security Valuation, 5th ed., McGraw Hill. Hawawini, G. and Viallet, C. (2011): Finance for Executives, 4th ed., South-Western Publishing.			

Prerequisites for participation in course
No prerequisites.
Modality of Exam
See 4.2

4.2.3 Strategic Financial Management

Course Name			
Strategic Financial Management			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Finance and Value	Prof. Dr. Martin E. Ruckes
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8

Overall Course Objectives

The course objective is to understand the main principles of finance and thereby be able to analyze corporate investment and financing decisions, such as

- valuation of risky cash flows and its application to corporate investments,
- financing choices and firm valuation.

Learning Targets

Participants

- are placed in a position to judge corporate investment projects from a financial point of view.
- gain a thorough comprehension of the main principles of business finance.
- are able to assess the value of business enterprises.

Course Content

This course begins with an overview of the environment in which financial decisions occur and of the financial information available. Investment rules, such as the net present value rule are applied to value securities and to capital budgeting. It follows the valuation of risky cash flow streams resulting from corporate projects or entire firms. After discussing the instruments of long-term financing, the decision to payout capital are addressed.

Literature

Hawawini, G. and Viallet, C. (2015): Finance for Executives, 5th ed., South-Western Publishing

Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 4.2

4.2.4 Case Studies

Course Name			
Case Studies			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Finance and Value	Prof. Dr. Martin E. Ruckes Dr. Jan-Oliver Strych
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Group Projects	Total 18h, hereof 7,5h contact hours, 10,5h homework and self-studies	0,6

Overall Course Objectives
Practice the valuation of a firm by applying concepts and methods from finance and accounting.
Learning Targets
Participants: ▪ perform business analysis to identify the firm's profit drivers and key risks, ▪ use financial data and other information to evaluate the current and past performance of the firm ▪ forecast a firm's future in terms of cash flows and/or earnings to practice a firm valuation under a pessimistic or optimistic view.
Course Content
▪ The case study centers around the valuation of a company and its equity using publicly available information. ▪ It is a group project where group assignments are available at the SharePoint. ▪ Each group makes a case for buying or selling the company's stock. This is done by performing a firm valuation and presenting it in class.
Literature
▪ Recent annual report of ase companies ▪ Presentation of case companies
Prerequisites for participation in course
▪ Participation in the course *Financial Accounting* and *Strategic Financial Management* is mandatory.

▪ Knowledge from both courses is necessary to perform the case study.
Modality of Exam
See 4.2

4.3 Decisions and Risk

Module Name			
Decisions and Risk			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Management	Prof. Dr. Stefan Nickel	6

Module Content

The module has the goal to make the students familiar with different facets of quantitative decision making comprising general model building, risk assessment, random effects, and multiple agents.

The module is divided into four courses: “Decision Modeling” serves as an elementary class (including software lab applications) targeting the development of basic quantitative modeling knowledge. Building upon this course, “Robust and Stochastic Optimization” and “Risk Aware Decisions” then focus on bridging the gap to reality by introducing different types of uncertainty and risk-awareness considerations into the models. Finally, “Interactive Decisions” analyzes from a game-theoretic point of view how decisions are made in the presence of multiple decision makers each focusing on individual interests.

Learning Results (LR)

Participants

- know and explain basic modelling techniques for quantitative decision making
- are capable of extending decision models to real world conditions involving different uncertainty representations (e.g., risk concepts, stochasticity) as well as practice-oriented features (e.g., industrial applications)
- apply decision support software systems to solve quantitative decision and optimization problems
- know and estimate game-theoretic effects in interactive decision making processes

Control of Success

Module with several examinations:

- Written examination of 60 minutes which comprises the courses “Decision Modeling” and “Risk Aware Decisions”.
- Written examination of 60 minutes which comprises the courses “Interactive Decisions” and “Robust and Stochastic Optimization”.
- The module grade shall be considered proportionally to the credits assigned to the courses.

The module contains the following study achievements:

- Case Study in course „Risk Aware Decisions“

Workload

Total 180h, hereof 75h contact hours, 105h homework and self-studies (hereof 65 during module, 40 in preparation of module)

Controls of Success In MM3 (4.3)	Modality of Examination	Performance and Duration of Examination	Prerequisites for exam-participation	Examination Period	Graded

4.3.1 Decision Modeling	Written examination	120 minutes	None	At the end of the module	Yes
4.3.2 Risk Aware Decision					
4.3.3 Interactive Decisions					
4.3.4 Robust and Stochastic Optimization					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

4.3.1 Decision Modeling

Course Name			
Decision Modeling (+Computer Tutorials)			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Decisions and Risk	Prof. Dr. Stefan Nickel
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8

Overall Course Objectives

The course has the goal to make the students familiar with theoretical and practical modelling techniques used for supporting quantitative decision making. Students gain knowledge in modeling systems behavior in specific industrial applications. Moreover, the usage of computers in practical applications of quantitative decision-making problems is highlighted in the software laboratory. An important benefit lies in the ability to assess and estimate general possibilities and fields of usage of decision support software for solving decision/optimization tasks in practice.

Learning Targets

Participants

- know and explain basic modelling techniques for quantitative decision making
- are able to formalize decision and optimization problems using decision support models
- are capable of extending decision models to real world conditions in order to achieve advanced models for industrial applications
- apply decision support software systems to solve quantitative decision and optimization problems
- know the limits of computer-supported problem solving based on complexity considerations

Course Content

Many real-life problems can be described and solved by decision support models. The course "Decision Modelling" tackles the modelling of decision and optimization problems by means of formal modelling methods and illustrates how these techniques can be utilized to solve real-world problems in business and industry applications. To this end, the course gives a concise discussion of modelling possibilities for quantitative decision making where the general goal is to design and operate a system under scarce resources.

With respect to a wide range of application possibilities, different modelling concepts are introduced with different focuses: mathematical programming as a general method for modelling and solving problems from different domains, queueing systems for analyzing waiting times and lines in queueing networks, multi-criteria concepts as possibilities to integrate multiple stakeholders into the decision making process, and scheduling as a special example of application-driven modelling.

Additionally, the course consists of a software laboratory part where students get on hands with state-of-the-art IT tools for mathematical modelling, optimization, simulation, and decision support. Fundamental problems from supply chain management, logistics, and health care are first introduced and modelled theoretically; afterwards these models are solved for exemplary data settings with computer software. As a result of the complexity of real-world settings, a final focus of the course is put on practical issues and limits of the presented modelling approaches as well as on a research outlook.

Literature

- Reid, Sanders: Operations Management - An integrated approach, Wiley, 2007
- Chase, Aquilano, Jacobs: Production and Operations Management: Manufacturing and Services, 8th edition, McGraw-Hill, 1998
- Vercellis: Business Intelligence - Data Mining and Optimization for Decision Making, Wiley, 2009
- Barbosa-Póvoa, Corominas, Miranda: Optimization and Decision Support Systems for Supply Chains, Springer, 2017
- Pinedo: Scheduling – Theory, Algorithms, and Systems, 2nd edition, Springer, 2012
- Stidham: Optimal Design of Queueing Systems, CRC Press, 2009
- Ehrgott: Multicriteria Optimization, Springer, 2000
- Sarker, Newton: Optimization Modelling - A practical approach CRC Press, 2008

Prerequisites for participation in course

Firm knowledge of the basics of mathematics and statistics as taught in Bachelor and Master university programs is expected.

Modality of Exam

See 4.3

4.3.2 Risk Aware Decisions

Course Name

Risk Aware Decisions (+Case Studies + Finance)

Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Decisions and Risk	Dr.-Ing. Iris Heckmann

Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and case study	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2

Overall Course Objectives

Each process and decision in business is prone to uncertainty. Wrong assessments and misjudgments may lead to unforeseen developments, which may have important consequences when detected (too) late. Accordingly, uncertainty needs to be continuously monitored and managed. Along with an increasing number of relevant uncertainties, the importance given to risk considerations has grown significantly in the recent decades. As a result, we have observed this term being applied to many different areas. Particularly, in supply chain management, researchers have felt the need to somehow capture risk in optimization models built for supporting the decision-making processes. Due to the increasing complexity and interrelation of modern networks, the type and nature of uncertain developments together with the impact of an action have become hard or even impossible to predict. Additionally, major disruptions like the 2011 flooding in Thailand, the eruption of the Icelandic volcano, or labor strikes, revealed a lack of preparedness of managers towards uncertain developments in general.

The main goal of this course is to make the students familiar with the challenges related to the decision-making process under risk as well as to available decision-support models.

Learning Targets

According to the overall course objectives, participants' learning targets include the following aspects:

- Knowledge of real case situations and cascading conditions that are referred to as "risk"
- Understanding of the concept risk as it is used in different application domains
- Knowledge of different quantification metrics – their definition as well as advantages and disadvantages of their application
- Knowledge of basic risk-aware modelling principles used to formulate decision-support models

Course Content

The course is divided into two parts. During the first part the students are provided with a bundle of real cases that demonstrates how disruptive events can result in major disruptions all referred to as risk. By the means of these real case situations, we explain the diversity of cascading effects that evolve over time and over networks. Corresponding, we define concepts strongly related to the concept of risk, define the concept risk itself and offer first modelling principles that have the ability to capture risk. At the end of the first part, the students have a broad understanding of risk and accompanying concepts.

In the second part of the course, we introduce existing decision-support models and discuss their usefulness with respect to their level of risk-awareness. Models are introduced with different application focus, e.g. facility location and allocation models, inventory models, network flow models, and with varying underlying methodology, e.g. stochastic programs, robust and chance-constrained models.

Literature

- Bernstein, P.L. (1998). Against the Gods: The remarkable Story of Risk. New York: John Wiley.
- Breakwell, G.M. (2007). The psychology of risk. Cambridge: Cambridge University Press.
- Chopra, S. and P. Meindl (2004). Supply Chain Management. New York: Pearson Education Inc.
- Ericson, C.A. (2005). Hazard Analysis Techniques for System Safety. Hoboken, NJ: John Wiley & Sons, Inc.
- Sheffi, Y. (2005). The resilient enterprise: Overcoming Vulnerability for Competitive advantages, Vol 1 of MIT Press Books. Cambridge: MIT Press.
- Simchi-Levi, D. (2010). Operations rules. Cambridge: MIT Press.

Prerequisites for participation in course

Firm knowledge of the basics of mathematics and statistics as taught in Bachelor and Master university programs is expected.
Modality of Exam
See 4.3

4.3.3 Interactive Decisions

Course Name			
Interactive Decisions			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Decisions and Risk	Prof. Dr. Clemens Puppe
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8

Overall Course Objectives
The objective of the course is to provide a rigorous introduction to game theory and its many applications in economics and the management sciences. The participants should also be made aware of the limitations of the classical approaches to the modelling of strategic interaction and be introduced to recent developments in behavioural economics.
Learning Targets
Participants understand the fundamental concepts and formal results of game theory in a mathematically rigorous way. The participants are able to infer the behavioural implications of game theory and can apply basic game theoretic models and concepts in real life contexts.
Course Content
Dominated and dominant strategies, Nash equilibrium, Prisoners' dilemma, Dynamic games and game trees, Subgame-perfect equilibrium, Games of incomplete information, Expected utility theory, Bayesian Nash equilibrium, Auction theory, Experimental game theory, Ultimatum and dictator games, Behavioral economics, Level-k thinking.
Literature
▪ R. Gibbons, A Primer in Game Theory, 1992. ▪ D. Kreps, Notes on the Theory of Choice, 1988. ▪ R. Pindyck & D. Rubinfeld, Microeconomics, 9th Edition, 2018.
Prerequisites for participation in course
No formal prerequisites, but basic knowledge of probability theory and calculus will be helpful.

Modality of Exam
See 4.3

4.3.4 Robust and Stochastic Optimization

Course Name			
Robust and Stochastic Optimization			
Semester	Module Type	Allocated to the following Module	Lecturers
2	Compulsory (course is assigned to student by examination board)	Decisions and Risk	Prof. Dr. Steffen Rebennack Dr. Marcel Sinske
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2

Overall Course Objectives

The course provides an up-to-date treatment of important aspects of optimization under uncertainty by applying techniques from robust and stochastic optimization. There are some connections with almost all other courses.

Learning Targets

Participants

- learn to understand how uncertainty can effect decisions in optimization problems
- become able to decide when uncertainty should be modelled in optimization problems
- gain knowledge in modelling uncertainties with robust and stochastic optimization techniques
- understand the advantages and disadvantages of robust and stochastic optimization
- are able to interpret solutions obtained by robust or stochastic optimization problems

Course Content

Uncertain decision problems, robust optimization, interval uncertainty, polyhedral uncertainty, stochastic optimization, deterministic equivalent, extensive form, scenario-trees, scenario generation, value-of-the-stochastic-solution, multi-stage problem formulation, chance-constraints, stochastic dynamic programming.

Literature

- “Robust Optimization”, by Aharon Ben-Tal, Laurent El Ghaoui and Arkadi Nemirovski, Princeton Series in Applied Mathematics, 2009
- “Introduction to Stochastic Programming”, by John R. Birge and François Louveaux, Springer Series in Operations Research and Financial Engineering, 2nd ed. 2011

Prerequisites for participation in course

Basic knowledge about Operations Research and basic familiarity with elementary probability theory and statistics.
Modality of Exam
See 4.3

4.4 Innovation and Projects

Module Name			
Innovation and Projects			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Management	Prof. Dr. Orestis Terzidis	6

Module Content

Technology represents a crucial source for new ventures and belongs to the most important drivers of competitive success. However, technology ventures have their own characteristics and require specific skills and techniques. The main objective of this module is to generate a deep understanding of technology venturing and the specific management approaches that address the characteristics of technology-driven innovation. The participants will learn specific techniques and methods to manage a technology venture.

For this purpose, this module consists of the two building blocks: Technology-driven innovation and project management.

Through the technology-driven innovation part of the module, participants will experience how to implement a technology-driven innovation approach and learn how to develop a successful product and a solid business model based on a new or existing technology. This includes the assessment of the technological strengths and limitations, the development of value profiles for technology applications, and a process for the selection of suitable applications and appropriate business models. Furthermore, this module addresses the fundamental key elements necessary to understand the challenges involved with intellectual property (IP) protection and elaborates a general understanding of the mechanisms of national and international IP law.

The second part of the module addresses the fact that the environment in which companies are operating has accelerated noticeably and is characterized by a high rate of market and technological changes. The technology, market, and competitive environment are developing continuously. As a result, companies are under constant pressure to adapt quickly to changing circumstances and offer a clear benefit to their customers and stakeholders. The vehicle to adapt the organization, address the stakeholder needs and implement a chosen strategy is the management of successful innovation projects. Therefore, entrepreneurial organizations need to manage and implement projects in highly dynamic business environments. The successful implementation of projects under such uncertain circumstances demands the use of methods that welcome changes and balance discipline and agility. Particularly in fast-paced international markets and markets with intensive competition, the use of highly adaptive methods is vital for the success of projects and the company. Through the project management training, the participants will gain a sound understanding of traditional and adaptive project management methods and learn how to implement successful projects. The participants will become familiar with a set of actionable tools to initiate, plan and manage projects, taught in interactive lectures and by working in groups.

Learning Results (LR)

LR-1: Develop a deep understanding of technology driven innovation and the management approaches necessary to succeed.

LR-2: Gain an overview of the fundamental principles of national and international Intellectual Property (IP) law as part of the global system of trade law

LR-3: Acquire tools, techniques and methods for the management of projects, in particular in international and intercultural context.

Workload

Total 180h, hereof 75h contact hours, 105h homework and self-studies (hereof 65 during module, 40 in preparation of module)

Controls of Success In MM 4 (4.4)	Modality of Examination	Performance and Duration of Examination	Prerequisites for exam-participation	Examination Period	Graded
4.4.1 Technology Driven Innovation	Examination of another kind	Presentation of Case Study, approx. 15 minutes per candidate	None	During course	Yes
4.4.2 International Intellectual Property Law	Study achievement	None	None	-	No
4.4.3 Project Management	Examination of another kind	Presentation of Case Study, approx. 15 minutes per candidate	None	During course	Yes
4.4.4 Multi-Project Management in an international setting	Study achievement	None	None	-	No
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

4.4.1 Technology Driven Innovation

Course Name			
Technology Driven Innovation			
Semester	Module Type	Allocated to the following Module	Lecturers
2	Compulsory (course is assigned to student by examination board)	Innovation and Projects	Prof. Dr. Orestis Terzidis
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, action learning, case studies	Total 72h, hereof 30h contact hours, 42h homework and self-studies	2,4
Overall Course Objectives			
Understanding the unique nature of technology driven innovation and be able to apply suitable tools, techniques and methods to succeed.			
Learning Targets			
Participants ▪ gain competencies of the principles and instruments of a technology driven innovation. ▪ learn how to differentiate market pull and technology push methods to drive innovation. ▪ experience a technology driven innovation process.			

Course Content
▪ Technology Push and Market Pull ▪ The Technology Application Selection (TAS) Process ▪ Technology Characterization ▪ Application Ideation ▪ Value Profile of Technology Applications ▪ Application Selection
Literature
▪ R.C. Dorf, T.H. Byers, Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008) ▪ T.N. Duening, R. D. Hisrich, M. A. Lechter, Technology Entrepreneurship, (Elsevier 2015) ▪ E. Ries, The Lean Startup (Crown Business 2011) ▪ A. Osterwalder, Y. Pigneur, Business Model Generation (Wiley 2010) ▪ B. Dorf, S. Blank, The Startup Owner's Manual (Ranch 2013) ▪ C. Volkmann, K. O. Tokarski, Entrepreneurship (German) (UTB 2006) ▪ U. Fueglistaller, C. A. Müller, T. Volery, Entrepreneurship (Springer-Gabler 2015) ▪ Peter Drucker, Entrepreneurship & Innovation (Routledge 1984/2015) ▪ W. Runge, Technology Entrepreneurship, KIT Scientific Publishing (2014) L. Vogel, O. Terzidis, Methods in Technology Push Development, G-Forum (2016), Paper to appear in Springer Series on Entrepreneurship in Spring 2018
Prerequisites for participation in course
Basic work experience in innovation and project management.
Modality of Exam
See 4.4

4.4.2 International Intellectual Property Law

Course Name			
International Intellectual Property Law			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Innovation and Projects	Sven Jacobs
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 18h, hereof 7,5h contact hours, 10,5h homework and self-studies	0,6
Overall Course Objectives			

The course aims at a general understanding of the mechanisms of international IP law, in particular, how the international system is built on the basis of the notion of territoriality and national law.
Learning Targets
Participants ▪ hold detailed knowledge of the main rights of intellectual property. ▪ analyze and evaluate more complex issues and adds them to a legal solution. ▪ transform the legal fundamentals in contracts about the usage of intellectual property and solve more complex violation cases. ▪ know and understand the basics of legal application procedures and have a wide overview of the legal matters caused by the internet.
Course Content
In international business relations, intellectual property plays an ever increasing role. In innovative industries and in the information society, patents, trademarks and copyrights often constitute the most valuable asset of a firm. Knowledge of how the international IP system works, how IP can be protected beyond national boundaries, is therefore an important part of managing problems of law and contracts. The course gives an overview of the fundamental principles of international Intellectual Property (IP) law as part of the global system of international trade law. The mechanisms of international protection by registration rights (patents, trademarks) and non-registration rights (copyright) are explained. The course focuses both on the legal rules and mechanisms in place and on the underlying philosophies of unification and harmonization of conflicting IP policy options and aims. The course also highlights institutional aspects of the WTO/TRIPS-system and of European harmonization in the area of IP.
Literature
▪ Goldstein, International Intellectual Property Law, Foundation Press, New York, 2001 (or later edition, if available at the time of the course) ▪ WIPO Intellectual Property Handbook – Policy, Law and Use, 2nd edition, Geneva, 2004. Wipo Publication No. 489(E).
Prerequisites for participation in course
Participants should have some basic knowledge and working experience in intellectual property (IP) law. Specialized knowledge in at least one of the major IP rights (patents; trademark; copyright) is advisable, but not a prerequisite.
Modality of Exam
See 4.4

4.4.3 Project Management

Course Name			
Project Management			
Semester	Module Type	Allocated to the following Module	Lecturers

2	Compulsory (course is assigned to student by examination board)	Innovation and Projects	Prof. Dr. Orestis Terzidis Dr. Abilio Avila
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, action learning and case studies	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8

Overall Course Objectives

Understand the general approach in project management for managing single and multiple projects. Learn how to plan, initiate and execute projects.

Learning Targets

Participants

- gain competencies of the principles and instruments of project management.
- gain skills to plan, initiate and execute projects.
- learn how to manage competing objectives and stakeholders.
- gain knowledge of various methods and procedures of project management and project controlling in a global context.

Course Content

- Fundamentals of Project Management
- Tools, Techniques and methods for the management of each phase of the project life cycle
- Traditional Project Management vs. Agile Project Management

Literature

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition, Project Management Institute
- The Fast Forward MBA in Project Management, Eric Verzuh
- Agile Product Management with Scrum: Creating Products That Customers Love, Addison-Wesley, Roman Pichle
- Scrum Guide 2013, Ken Schwaber, Jeff Sutherland
- Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia Business School Publishing), Jeanne Liedtka, Tim Ogilvie
- Operations Research, Stefan Nickel, Oliver Stein, Karl-Heinz Waldmann, 2014, Springer-Lehrbuch
- B.P. Lientz, K.P. Rea: International Project Management, 2002

Prerequisites for participation in course

Professional basic knowledge in project management, such as project planning, risk assessment for projects and project controlling. Open-mindedness.

Modality of Exam

See 4.4

4.4.4 Multi-Project Management in an International Setting

Course Name			
Multi-Project Management in an International Setting			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Innovation and Projects	Dr.-Ing. Robert Landwehr
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and case studies	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2

Overall Course Objectives

Because of the growing importance of project work and the increasing internationalization of projects, this course focuses on complex multi-project management approaches in global environment. The content of the course “Project Management” is extended by introducing methods and tools for managing single and multiple projects. Another point of focus is the organization and the financing of international projects. The content of the course is complemented by industrial examples to provide a practical reference.

The concerted aim is to impart the basic knowledge of project, development and innovation management.

Learning Targets

Participants

- gain knowledge of various methods and procedures of project management and project controlling in a global context.
- are able to analyze problem areas of project management in international and intercultural coherences and to specifically contribute to the improvement of project management in an intercultural environment.
- are able to structure a project portfolio in critical and confusing situations and to make proposals to the top-management about the evaluation and selection or prioritization of projects.
- are capable to systematically establish and apply a multi-project management system including related tools and processes (including project portfolio analysis, program management, risk evaluation, interdependency analysis etc.) with the aid of the mediated knowledge in a business (respectively at a location).

Course Content

- Identification of the main characteristics and problems of international single and multi- project management
- Introduction of methods and tools for multi-project management
- Discussion of the organization and financing as well as the cultural aspects of international single and multi-project management
- Analysis of real world business cases

Literature

- B.P. Lientz, K.P. Rea: International Project Management, 2002

Owen J. Murphy: International Project Management; South-Western Pub 2005; ISBN: 0324203020
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 4.4

4.5 Strategy and People

Module Name			
Strategy and People			
Semester	Subject	Module Supervisor	Credit Points for Module
3	Management	Prof. Dr. Petra Nieken	6

Module Content

In today's rapidly changing business environments managers constantly face new challenges regarding business strategies while at the same time they have to ensure to keep their employees motivated and committed to the companies' goals. The majority of companies have explicitly HR driven strategies as the motivation of their employees, their commitment and their creativity are core factors for the company's success.

The module "Strategy and People" combines business strategy and corporate law with current challenges of managing organizations, human resource strategy, and leadership concepts. It introduces students to the overall process of strategic management such as strategy formulation, analysis and evaluation. Students learn how to identify and analyze sources of competitive advantage and formulate strategies for different company levels. In a second step, students get insights into business and corporate law including corporate governance and compliance issues that shape economic decisions. In a third step, strategic HR Management shows how strategic decisions are linked to HR practices as it is crucial that the employees understand and support the company's goals. Understanding how individuals and teams behave within a company and how incentive systems and performance measurement influence performance will be main topics of this module. The impact of digital transformation, global teams and diversity a well as selected leadership concepts will be discussed and practical training will be provided.

The module provides evidence based knowledge about core tasks of each manager. Game theoretic elements, behavioral approaches as well as evidence based management concepts and data-driven approaches provide a structured and rigorous framework that enables the students to apply tools and concepts to a wide variety of business situations. Case studies and class room experiments ensure a hands-on approach in handling complex information and datasets that guarantees a strong link to practice. After the course, students will be able to analyze and shape strategy as well as implement it while ensuring to keep their employees motivated in a fast changing environment.

Learning Results (LR)

LR 1: Understanding of central concepts of strategic management, strategy planning and implementation. Knowledge of corporate and business law and its impact on business strategy.

LR 2: Knowledge about the strong interaction between business strategy, human resources and business success. Understanding how incentive systems, corporate guidelines, and behavior influence the motivation and performance of the workforce.

LR 3: Detailed knowledge of business concepts, economic concepts, HR practices, and leadership concepts. Ability to use this knowledge in day-to-day management situations.

Workload

Total 180h, hereof 75h contact hours, 105h homework and self-studies (hereof 65 during module, 40 in preparation of module)

Controls of Success In MM 5 (4.5)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-Participation	Examination Period	Graded
4.5.1 Strategic Management	Examination of another kind	Presentation of Case Study, approx. 15 minutes per candidate	None	During course	Yes
4.5.2 Managerial Economics	Study Achievement	None	None	-	No
4.5.3 Business Organization and Corporate Law	Written examination	60 minutes	None	At the end of the course week	Yes
4.5.4 Strategic Human Recourse Management	Examination of another kind	Presentation of Case Study, approx. 15 minutes per candidate	Case Study (group work)	During course	Yes
4.5.5 Leadership and Conflict Management	Study Achievement	None	None	-	No
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

4.5.1 Strategic Management

Course Name			
Strategic Management			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Strategy and People	Prof. Dr. Kerstin Fehre
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2
Overall Course Objectives			
Major course objectives are to explain the process of strategic management and to analyze business situations from the internal and external perspective. The formulation of strategies on the business unit and on the corporate level and the evaluation of strategic options based on competitive advantages are introduced and discussed. Furthermore, a major objective is to access existing business portfolios from a strategic perspective.			
Learning Targets			
Participants			

▪ are able to describe central concepts of strategic management alongside the ideal-typical strategy process. ▪ are able to undertake internal and external strategic analyses (e.g. SWOT Analysis) with the goal of strategy formulation. ▪ understand the classical concepts and sources of competitive advantages as well as their meaning for the formulation of competitive and business strategies. ▪ are able to formulate strategies at a company level and at a business unit level. ▪ understand the central principles of strategy evaluation and strategy implementation as well as the classical concepts of change management.
Course Content
The course introduces the overall process of strategic management containing strategic analysis, strategy formulation, strategy evaluation based on competitive advantage, and portfolio strategy. The overall process is used as the structuring element, each step will be analyzed and explained in detail. In addition, students learn and experience the most important concepts of strategy formulation in oligopolies. A special emphasis is put on the integration, discussion and application of the frameworks. Several case studies will confirm the attained knowledge.
Literature
Robert M. Grant: Contemporary Strategy Analysis, Blackwell, 7th ed. 2010
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 4.5

4.5.2 Managerial Economics

Course Name			
Managerial Economics			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Strategy and People	Prof. Dr. Clemens Puppe
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 18h, hereof 7,5h contact hours, 10,5h homework and self-studies	0,6
Overall Course Objectives			
The objective of the course is to provide a rigorous analysis of the basic determinants of labour supply and incentives at the workplace. Particular attention is given to recent developments in the application of behavioural economics to organisational design.			

Learning Targets
Participants understand the fundamental concepts of microeconomic theory and behavioural economics relevant to organisational and contract design. The participants are able to infer the behavioural implications of the theoretical concepts and can apply them in real life contexts.
Course Content
Demand for leisure time and the structure of labor supply, symmetric versus asymmetric information models, efficiency wages, monetary versus non-monetary incentives, job market signaling.
Literature
▪ R. Gibbons, A Primer in Game Theory, 1992. ▪ R. Pindyck & D. Rubinfeld, Microeconomics, 9th Edition, 2018.
Prerequisites for participation in course
No formal prerequisites, but basic knowledge of probability theory and calculus will be helpful.
Modality of Exam
See 4.5

4.5.3 Business Organization and Corporate Law

Course Name			
Business Organization and Corporate Law			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Strategy and People	Prof. Dr. Martin Schulz
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and case studies	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2
Overall Course Objectives			
Participants ▪ will understand the relevance of law for business organizations and their stakeholders (also in cross border cases). ▪ gain insight into important forms of business organizations (including corporate governance aspects). ▪ learn central issues of business law and corporate compliance (including managerial liability and legal risk management). ▪ will recognize the interdependence of corporate governance and business law within a globalized economy.			
Learning Targets			

Participants will understand the impact of law on entrepreneurial activities and become familiar with important forms of business organizations. They learn how to deal with corporate law issues and relevant aspects of corporate governance and compliance management (including cross border elements). Participants learn how to structure and communicate legal issues in international business law cases.
Course Content
This course provides an insight into important business law issues and legal risk management relevant to managerial practice including corporate governance and compliance issues. After outlining the German corporate legal framework, we will discuss some crucial issues of international and European business law, such as the law applicable to corporations engaged in cross-border activities. We will analyze typical cases in corporate practice with a special focus on the role and responsibility of managers. Key practical issues such as the choice of suitable business forms, corporate governance and compliance issues as well as the liability of shareholders and managers will also be discussed and analyzed.
Literature
▪ Kraakman, Reinier et al., The Anatomy of Corporate Law - A Comparative and Functional Approach, 3rd edition Oxford 2017. ▪ Schulz, Martin/ Wasmeier, Oliver. The Law of Business Organizations – A Concise Overview of German Corporate Law, Heidelberg 2012. ▪ Bagley, Winning Legally, How to use the law to create value, marshal resources and manage risk, Boston 2005.
Prerequisites for participation in course
A basic knowledge of German as well as basic knowledge of legal concepts (such as contracts) is helpful.
Modality of Exam
See 4.5

4.5.4 Strategic Human Resource Management

Course Name			
Strategic Human Resource Management			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Strategy and People	Prof. Dr. Petra Nieken
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, case study, project work, classroom experiment	Total 54h, hereof 22,5h contact hours, 31,5h homework and self-studies	1,8
Overall Course Objectives			

The course aims at a fundamental understanding of the challenges of human resource management processes and their link to strategic decision making. It combines evidence based management concepts, behavioral economics, and data-driven approaches to provide a rigorous framework that enables students to apply HRM tools and practices. An overview of state-of-the art methods and research topics in HRM is provided.
Learning Targets
Participants will be made familiar with relevant challenges of human resource management and selected aspects of leadership and will gain insight into current research on behavior in organizations. The course enables students to understand and analyze strategic situations regarding individual behavior and human resource development in organizations.
Course Content
Today the majority of companies have explicitly HR driven strategies as the motivation of their employees, their commitment and their creativity are core factors for the company's success. This course shows how strategic decisions are linked to HRM and covers various topics of human resource management and leadership in organizations. Evidence based management concepts, concepts from behavioral economics, and data-driven approaches will be complemented by classroom experiments and empirical research results based on company as well as laboratory data. By introducing participants to evidence-based HR-management, they become familiar with current attempts to measure the success of HR development instruments. We will cover topics such as linking HRM processes to the company's strategy, career and talent management, performance appraisal systems, employee motivation, and company training. Participants will work in teams on case studies that are distributed before the course starts. These real-world examples offer insights into practical HR-issues and leadership problems and illustrate a variety of challenges of HR management.
Literature
▪ Cascio, W.F.: Managing Human Resources, McGraw-Hill, 2013 ▪ Lazear, E. P. and M. Gibbs: Personnel Economics in Practice. John Wiley & Sons, 2015. ▪ Huselid, M.A., Becker, B.E. and Beatty, R.W. (2005): The workforce scorecard: Managing human capital to execute strategy. Harvard Business School Press. ▪ Northouse, Peter G. (2015): Leadership: Theory and Practice, SagePublications
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 4.5

4.5.5 Leadership and Conflict Management

Course Name			
Leadership and Conflict Management			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by	Strategy and People	Dr.-Ing. Tobias Kunkel

	examination board)		
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 36h, hereof 15h contact hours, 21h homework and self-studies	1,2

Overall Course Objectives

Participants acquire a holistic understanding of the complexity of leadership behavior. They are able to critically reflect underlying mechanisms and assess the appropriateness of different leadership styles for different situations. In addition, they have an insight into the emergence of conflicts and know methods to solve them constructively.

Learning Targets

Participants

- know important psychological basics of social interaction and communication.
- acquire knowledge of different leadership approaches and are able to compare them critically.
- learn how to apply conflict solving methods.
- are encouraged to reflect on their own leadership behavior.

Course Content

- Fundamentals of social psychology
- Fundamentals of communication
- Leadership theories
- Methods and models for dealing with conflicts

Literature

- Aronson, E., Wilson, T. D. & Akert, R. M. (2013). *Social Psychology* (8. Aufl.). Boston: Pearson.
- Nerdinger, F. W., Blickle, G. & Schaper, N. (2014). *Arbeits- und Organisationspsychologie* (3. Aufl). Berlin, Heidelberg: Springer.
- Schulz von Thun, F. (2010). *Miteinander reden* (48. Aufl.). Reinbek: Rowohlt Taschenbuch-Verlag.
- Winkler, I. (2010). *Contemporary leadership theories. Enhancing the understanding of the complexity, subjectivity and dynamic of leadership*. Heidelberg, New York: Physica-Verlag.

Prerequisites for participation in course

Successful participation in the lecture „Project Management".

Modality of Exam

See 4.5

5 Description of the Engineering Modules

5.1 Digital Platforms

Module Name			
Digital Platforms			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Engineering	Prof. Dr. Alexander Mädche	8
Module Content			
The module enables participants to understand and engineer digital platforms for organizations and markets in order to drive internal and external digitalization. The module first introduces state-of-the-art Enterprise System platform architectures and concepts covering a process-, information-, and people-centric perspective. Furthermore, participants understand socio-technical trade-offs in the implementation and management process of digital platforms in organizations. Complementing the organizational perspective, market engineering puts an emphasis on the design of information-centric markets and services in order to realize new digital business models. Finally, this module also introduce key concepts and technologies of the Internet of Things (IoT) as an enabler for realizing contemporary digital platforms.			
Learning Results (LR)			
LR-1: Knowledge of fundamental characteristics of digital platforms for organizations and markets LR-2: Ability to design and engineering digital markets for realizing new digital business models LR-3: Knowledge of the fundamental concepts and technologies of the Internet of Things LR-4: Experience in working in groups on independent case studies in order to design and manage digital platforms successfully			
Workload			
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).			

Controls of Success In EM 1 (5.1)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-Participation	Examination Period	Graded
5.1.1 Enterprise Systems	Examination of another kind	Case Study Presentation, approx. 10 minutes per participant in revision	None	During course	Yes
5.1.2 IoT Technologies & Platforms	Written examination	60 minutes	None	At the end of the course week	Yes
5.1.3 Platform & Market Engineering	Written examination	60 minutes	None	At the end of the course week	Yes
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.1.1 Enterprise Systems

Course Name			
Enterprise Systems			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Digital Platforms	Prof. Dr. Alexander Mädche
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and Exercises	Total 72h, hereof 22,5h contact hours, 49,5h homework and self-studies	2,4

Overall Course Objectives

Enterprise Systems (ES) refer to specific information systems denoted as the backbone of enterprises' operations with a high integration level and great multi-dimensional impact. Historically, the term ES has often been used as a synonym for packaged application software, such as Enterprise Resource Planning (ERP) or Customer Relationship Management (CRM) (Liang et al. 2007). With the blurring boundaries of transactional-, analytical-, and people-centric systems, nowadays the term ES covers all organizational-wide IS as well as associated platforms.

Enterprise systems (ES) in organizations strongly interplay with work practices of individual employees as well as organizational structures shaping and being shaped by individuals' behavior. Thus, the successful implementation of ES requires dealing with transformation beyond technology. The ability to implement and use ES in a way supporting its overall value proposition has become a central success determinant for digital transformation.

The course introduces state-of-the-art Enterprise System platform architectures and key concepts covering a process-, information-, and people-centric perspective. Furthermore, it also emphasizes socio-technical factors in the implementation and management process of Enterprise Systems in organizations.

Learning Targets

Participants:

- Get an overview on basic concepts and definitions of Enterprise Systems (ES) and understand key characteristics of ES as a foundation for the digitalization of organisations, products, and services
- Understand the importance of Enterprise Systems organizations and be aware of socio-technical aspects for the successful implementation and management of digital platforms of organizations.

Course Content

Currently under revision

Literature

Literature will be distributed with the course materials.

Prerequisites for participation in course

No prerequisites required.

Modality of Exam
See 5.1

5.1.2 IoT Technologies and Platforms

Course Name			
IoT Technologies and Platforms			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Digital Platforms	Prof. Dr. Martina Zitterbart PD Dr. Roland Bless
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 48h, hereof 15h contact hours, 33h homework and self-studies	1,6

Overall Course Objectives
Participant become familiar with concepts and technologies for the Internet of Things (IoT) and understand opportunities and challenges in designing IoT solutions, in particular with respect to networking aspects.
Learning Targets
Participants • understand basic properties and features of IoT and are capable to evaluate and select proper platforms • have the basic skills to analyze and build IoT systems • understand the implications of IoT systems with respect to privacy and security and are able to apply corresponding protection methods • are aware of the basic communication methods and protocols in IoT and their applicability in certain application scenarios
Course Content
The course provides insights into selected aspects of IoT systems, platforms, and applications. Some focus is on wireless communication, industry-relevant technologies and platforms, such as 6LowPAN and ZigBee. The underlying methods and protocols are analyzed. Furthermore, important aspects regarding practical applications, e.g., in Industry4.0 and smart city, are discussed. This includes, for example, energy awareness, privacy and security.
Literature
Literature will be distributed with the course materials.
Prerequisites for participation in course

Basic knowledge on networked systems.
Modality of Exam
See 5.1

5.1.3 Platform and Market Engineering

Course Name			
Platform and Market Engineering			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Digital Platforms	Prof. Dr. Christof Weinhardt
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 120h, hereof 37,5h contact hours, 82,5h homework and self-studies	4,0

Overall Course Objectives
A platform is a business model that creates value by facilitating exchanges between two or more interdependent groups, usually consumers and producers. Digital platforms are rapidly and fundamentally transforming our economy. For example, they change the way we shop and thus tackle traditional business models like shopping malls, and shopping catalogues. Another aspect is that they are creating new business models of how we purchase items (e.g., monthly fees for unlimited access to videos, music, or books). This course aims at introducing students to the most important aspects of platform economics and market engineering.
Learning Targets
The goal of the course is to make students understand mechanisms, business models, and network effects of digital platforms and learn about different types of market designs. Students will know about the latest trends in practice and research in the field of platform economy. They will be able to categorize and analyze digital platforms. Moreover, they are able to analyze and critically reflect platforms and market designs based on empirical studies. They can deduce recommended actions and reflect on them also against a social background. Finally, they learn how to effectively design new platforms given a new business idea.
Course Content
The lecture introduces platform economy-related topics such as: • Foundations of Market Engineering • Auctions • Social Network Analysis • Peer-to-Peer Platforms • Network Effects & Business Models • Webscraping/ Crawling • Experimental Economics

Trust and Enforcement
Literature
• Bundesministerium für Wirtschaft und Energie (2017). „Kompetenzen für eine digitale Souveränität“ (abrufbar unter https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/kompetenzen-fuer-eine-digitale-souveraenitaet.html) • Easley, D., and Kleinberg, J. 2010. “Network Effects,” in Networks, Crowds, and Markets: Reasoning about a Highly Connected World, Cambridge University Press, pp. 509–542. • Eisenmann, T., Parker, G., and Van Alstyne, M. W. 2006. “Strategies for two-sided markets,” Harvard Business Review 84(10), pp. 1–11. • Gassmann, O., Frankenberger, K., and Csik, M. 2013. Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator, Hanser. • Roth, A., The Economist as Engineer: Game Theory, Experimental Economics and Computation as Tools for Design Economics. Econometrica 70(4): 1341-1378, 2002. • Smith, V. "Theory, Experiments and Economics", The Journal of Economic Perspectives, Vol. 3, No. 1, 151-69, 1989 • Weinhardt, C., Holtmann, C., Neumann, D., Market Engineering. Wirtschaftsinformatik, 2003. • Wolfstetter, E., 1999. “Topics in Microeconomics - Industrial Organization, Auctions, and Incentives,” Cambridge University Press.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.1

5.2 Software Engineering

Module Name			
Software Engineering			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Engineering	Prof. Dr. Ralf Reussner	8

Module Content
The module “Software Engineering” focuses on two key parts: First, a holistic perspective on all stages of software systems development is provided. Second, a specific emphasis is set on developing large-scale web applications as well as leveraging cloud computing concepts and technologies for state-of-the-art software development and deployment. The first course covers all stages of software systems development: systems planning, analysis and design, testing and implementation, as well as maintenance. Special focus is placed on embedding software systems in technical or socio-technical environments. Different process models for software development are considered, including agile software development. Furthermore, specific methods for software quality prediction and management, configuration management, software reuse, and cost estimation are presented. Additionally, software components and software architectures are treated in detail. The second course explains current modeling and markup languages (e.g. UML, HTML) as well as protocols (e.g. HTTP, SOAP) as a foundation to understand the architecture of web applications. Finally, cloud computing concepts and technologies taught within the module enable the participants to assess the opportunities and challenges of web-scale service applications.
Learning Results (LR)
LR-1: Know methods and tools for the different stages of software systems development and maintenance. LR-2: Ability to apply advanced web standards to design service-oriented and web-based systems. LR-3: Knowledge how to use methods, procedure models, and tools for efficient development of complex software systems with high demands on quality. LR-4: Achievement of thorough methodological skills to provide IT resources and services in cloud environments.
Workload
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).

Controls of Success In EM 2 (5.2)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-Participation	Examination Period	Graded
5.1.1 Software and Systems Engineering	Written examination	60 minutes	None	At the end of the course week	Yes
5.1.2 Advanced Web Applications	Written examination	60 minutes	None	At the end of the course week	Yes
5.1.3 Cloud Computing					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.2.1 Software and Systems Engineering

Course Name			
Software and Systems Engineering			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Software Engineering	Prof. Dr. Walter F. Tichy Prof. Dr. Ralf Reussner Dr. Robert Heinrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 120h, hereof 37,5h contact hours 82,5h homework and self-studies	4

Overall Course Objectives

The objective of this course is to provide participants with a profound survey of methods and tools for the different stages of software systems development and maintenance. The courses in EM2 (Service Technologies) cover material that is closely related to the topic of this course.

Learning Targets

Participants

- know methods and tools for software development (for example MDSD) and maintenance.
- get to know component based software developments and are able to recognize the connection to engineering software development and to software architectures.
- visualize the advantages and disadvantages of these component models. In order to be able to critically rate the most important techniques and procedures from experience and research are conveyed, like for example performance-forecast of draft time and code-generation from models.
- learn and applies currently used technologies (EJBs, SOA etc.) as well as current research focuses, for example model transformations into the development of software prototypes.
- learn the systematic work with architecture descriptions through structured methods for architecture evaluation (for example SAAM)

Course Content

The course covers all stages of software systems development: systems planning, analysis and design, testing and implementation, as well as maintenance. Special focus is placed on embedding software systems in technical or sociotechnical environments. Different process models for software development are considered. Specific methods for software quality prediction and management, configuration management, software reuse, and cost estimation are presented. Software components and software architectures are treated in detail.

Literature

B. Bruegge, A.H. Dutoit: Object-Oriented Software Engineering Using UML, Patterns, and Java, 3rd Edition, Prentice Hall, 2009 and additional journal articles.

Prerequisites for participation in course
The course requires some basic knowledge in informatics, especially in modeling approaches. Therefore it is strongly advantageous to have completed EM1.
Modality of Exam
See 5.2

5.2.2 Advanced Web Applications

Course Name			
Advanced Web Applications			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Service Technologies	Dr. Robert Heinrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 72h, hereof 22,5h contact hours 49,5h homework and self-studies	2,4

Overall Course Objectives

The course objectives are to:

- understand the architecture of multi-layered and service-oriented web applications.
- know the modeling language UML to describe an architecture and to give examples that show how this language is applied in a given scenario.
- understand basic web technologies including HTTP, SOAP, WSDL.
- know concepts and technologies to compose basic web services to complex web services oriented on business processes.
- understand the reasons for service-oriented architectures as paradigm to support business processes.
- be aware of a methodology to specify business processes and to derive appropriate service designs.

Learning Targets

Participants

- are familiar with modern development tools as well as current modeling and programming languages (including HTTP, SOAP, WSDL).
- gain knowledge of the architecture of multilayered and service-oriented web applications.

Course Content

The architecture of a web-based system comprises the architecture of the web application and the architectures of the underlying networked system. Multi-layered application architectures and Service-Oriented Architectures (SOA) based on web service standards are introduced and languages to model and specify these architectures are presented.

An insightful overview of process-oriented integration of existing IT-Systems is discussed. Service-Oriented Architectures (SOA) are used as an integration platform. To implement this next generation integration architecture, an in-depth look into the key web service technologies and their fundaments will be undertaken. In addition methods and technologies are discussed to compose basic web services to complex web services and to build advanced web applications oriented on business processes.
Literature
▪ Thomas Erl, Anish Karmarkar et al.: Web Service Contract Design and Versioning of SOA, Prentice Hall, 2009. ▪ Michael P. Papazoglou: Web Services: Principles and Technology, Pearson Education, 2008.
Prerequisites for participation in course
Fundamental knowledge of communication architectures and protocols (esp. architecture of the internet and web) and programming experience (e.g. Java) are pre-requisites.
Modality of Exam
See 5.2

5.2.3 Cloud Computing

Course Name			
Cloud Computing			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Service Technologies	Prof. Dr. Ralf H. Reussner Dr. Robert Heinrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6
Overall Course Objectives			
The participant becomes familiar with concepts and technologies of Cloud Computing and understands opportunities and challenges in the engineering and management of Web-scale services.			
Learning Targets			
Participants learn and apply concepts, methods and technologies of Cloud Computing for the supply and usage of IT-resources, development and operating time environments and applications of various kind as services in the web.			
Course Content			

Building on computer and storage virtualization Cloud Computing provides scalable, network-centric, abstracted IT infrastructure, platforms, and software applications as on-demand services that are billed by consumption. Innovative business models, cost efficiency, and faster time-to-market are the expected benefits associated with Cloud Computing. The lecture introduces concepts and technologies of Cloud Computing covering topics such as: ▪ Fundamentals: Virtualization, Service-orientation. ▪ Commercial and Open-Source Cloud offerings. ▪ Cloud service engineering. ▪ Web-scale Cloud service architecture. ▪ Cloud service management. ▪ Cloud economics. ▪ Obstacles and opportunities.
Literature
None
Prerequisites for participation in course
Basic programming experience (e.g. Java) and fundamentals of Web and Web services computing are desired.
Modality of Exam
See 5.2

5.3 Process and Knowledge Engineering

Module Name			
Process and Knowledge Engineering			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Engineering	Prof. Dr. Andreas Oberweis	8
Module Content			
Currently under revision			
Learning Results (LR)			
LR-1: *Currently under revision* LR-2: *Currently under revision* LR-3: *Currently under revision* LR-4: *Currently under revision*			
Workload			
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).			

Controls of Success In EM 3 (5.3)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.3.1 Business Process Engineering	Examination of another kind	Case Study presentation, approx. 10 minutes per participant	None	At the end of the course week	Yes
5.3.2 Process Mining					
5.3.3 Data & Knowledge Engineering	Written examination	60 minutes	None	At the end of the course week	Yes
5.3.4 Big Data Management					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.3.1 Business Process Engineering

Course Name
Business Process Engineering

Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Process and Knowledge Engineering	Prof. Dr. Andreas Oberweis
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 72h, hereof 22,5h contact hours 49,5h homework and self-studies	
Overall Course Objectives			
Currently under revision			
Learning Targets			
Participants ▪ *Currently under revision*			
Course Content			
Currently under revision			
Literature			
Currently under revision			
Prerequisites for participation in course			
Currently under revision			
Modality of Exam			
See 5.3			

5.3.2 Process Mining

Course Name			
Process Mining			
Semester	Module Type	Allocated to the following Module	Lecturers
2	Compulsory (course is assigned to student by examination board)	Process and Knowledge Engineering	Prof. Dr. Andreas Oberweis

Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	
Overall Course Objectives			
Currently under revision			
Learning Targets			
Participants ▪ *Currently under revision*			
Course Content			
Currently under revision			
Literature			
Currently under revision			
Prerequisites for participation in course			
Currently under revision			
Modality of Exam			
See 5.3			

5.3.3 Data and Knowledge Engineering

Course Name			
Data and Knowledge Engineering			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Process and Knowledge Engineering	Prof. Dr. York Sure-Vetter
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 72h, hereof 22,5h contact hours 49,5h homework and self-studies	2,4
Overall Course Objectives			

To provide a framework of interdisciplinary knowledge, methods and skills to support understanding of Information and Knowledge Management with a focus on semantic web and web 2.0-technologies as well as semantic web services.
Learning Targets
Participants ▪ get to know and to apply methods and instruments in the area of “Information and Knowledge Management” and to demonstrate the capability to be innovative regarding the applied methods. ▪ learn the practical application of the use of semantic web-based systems. ▪ are capable of choosing and correctly applying the appropriate methods for the arising problems as part of the daily tasks. ▪ are put in the position to find and represent arguments for problem solving.
Course Content
The course primarily deals with recent technical advancements in Information and Knowledge Management with a focus on semantic web technologies and semantic web services. The course provides an overview of fundamental aspects and a general introduction to the topics. Practical tools and applications are jointly explored and give a hands-on experience to state-of-the-art semantic web- and web 2.0-technologies and how they can be used in corporate environments. In addition, semantic web services as a new paradigm for modeling, orchestrating and executing services are presented. Practical applications based on semantic web services are used to illustrate the potentials of the new technology.
Literature
▪ „Foundations of Semantic Technologies“; P. Hitzler, M. Krötzsch, S. Rudolph; CRC Press; 2009. ▪ Handbook of Ontologies“ by Staab/Studer (eds.) Springer Verlag 2009
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.3

5.3.4 Big Data Management

Course Name			
Big Data Management			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Process and Knowledge Engineering	Prof. Dr. York Sure-Vetter
Recurrence	Mode of Teaching	Workload	Credit Points for Course

Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6

Overall Course Objectives

The course teaches the fundamentals of Big Data, including real-world cases, as well as current technical challenges and opportunities of Big Data. Participants will learn the foundational algorithms of large-scale distributed systems. Further, participants will learn how to make use of available technologies to manage Big Data on cloud infrastructures and to perform data analytics tasks. The hands-on sessions will include setting up a cloud environment, and querying and visualizing a large dataset.

Learning Targets

After completing the course, participants are able to:

- explain the V's of Big Data.
- outline the distributed architectures and core components used in Big Data systems.
- explain Brewer's CAP theorem.
- select NoSQL systems appropriate for given requirements.
- outline the use of similarity metrics for data mapping.
- explain steps involved in large-scale data integration and data analytics.

Course Content

The course presents an overview of methods and technologies related to Big Data including:

- Distributed Systems and Cloud Computing.
- Foundational Big Data Technologies.
- Theory and Practice of NoSQL Systems.
- Big Linked Data.
- Exploiting Similarity Measures for Data Integration.

The course concludes with an outlook on further topics, including data mining and machine learning.

Literature

Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, http://mmds.org/.

AnHai Doan, Alon Halevy, Zachary Ives, Principles of Data Integration, Morgan Kaufmann, 2012.

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.3

5.4 Security and Privacy Engineering

Module Name			
Security and Privacy Engineering			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Engineering	*Currently under revision*	8

Module Content
This module addresses various aspects of security and privacy engineering. After a general introduction in information security, the module will focus on applied cryptography and network security. Afterwards, students get an introduction into data protection laws. Finally, very specific applications are discussed and how emerging technology is used e.g. in order to provide an adequate level of security, privacy and safety in critical (information) infrastructures.
Learning Results (LR)
LR-1: Basic concepts of information security (such as the security goals confidentiality, integrity, authenticity, availability; risk assessment incl. threat analyses and the concept of assumptions) and an overview of protection mechanisms LR-2: Basis crypto primitives and their application in crypto protocols LR-3: Basic networking functionality (incl. routing and name services) and common attacks on routing, naming, denial of service LR-4: Fundamental characteristics of data protection regulations, e.g. GDPR and data protection case-law as well as their application in software design LR-5 Foundational knowledge about the design and operation of critical (information) infrastructures and related Internet technologies incl. the application of emerging technologies such as distributed ledger technology in these contexts.
Workload
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).

Controls of Success In EM 4 (5.3)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.4.1 Information Security	Written examination	60 minutes	None	At the end of the course week	yes
5.4.2 Applied Cryptography					
5.4.3 Network Security	Written examination	60 minutes	None	At the end of the course week	yes
5.4.4 Data Protection Regulations					
5.4.5. Emerging Technologies &					

Critical Information Infrastructures					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.4.1 Information Security

Course Name			
Information Security			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Security and Privacy Engineering	Dr. Patricia Arias Cabarcos
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6

Overall Course Objectives

The course will focus on basic concepts of information security (such as the security goals confidentiality, integrity, authenticity, availability; risk assessment incl. threat analyses and the concept of assumptions) and provide an overview of protection mechanisms including their advantages and disadvantages.

Learning Targets

Participants

- know the basic terminology (e.g. security, safety, risk, assumptions) and various security goals (e.g. confidentiality, integrity, authenticity)
- know how to perform a threat analyses
- know the concepts social engineering and understand the importance of human factors in security
- know the basics about core security protection mechanisms such as encryption, signing, passwords, 2FA

Course Content

The course presents an overview of methods and technologies related to information security. The focus is on the application layer and security mechanisms end users are in touch with. The underlying cryptographic primitives and cryptographic protocols will be addressed in the course on ‘Applied Cryptography’.

Literature

Literature will be distributed with the course materials.

Prerequisites for participation in course

No prerequisites required.
Modality of Exam
See 5.4.

5.4.2 Applied Cryptography

Course Name			
Applied Cryptography			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Security and Privacy Engineering	Prof. Dr. Jörn Müller-Quade
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6

Overall Course Objectives

The course “Applied Cryptography” gives an introduction to modern cryptography, teaches the most relevant cryptographic schemes, and enables the participants to judge the security provided by different cryptographic schemes. The course further lays some mathematical foundations, to allow the participants to understand the security of cryptographic protocols instead of taking this by faith.

Learning Targets

Participants

- Understand and explain symmetric cryptography, including historic failures like the Enigma, modern block ciphers, modes of operation, hash functions, and message authentication codes.
- Understand and explain public key cryptography, including the Diffie Hellman Key Exchange, the RSA crypto system, digital signatures as well as the relevant security definitions IND-CPA and EUF-CMA.
- Understand and explain basic cryptographic protocols like identification schemes or simple zero-knowledge protocols.
- Understand and explain the methodology of provable security as well as the limits of this approach.

Course Content

The course “Applied Cryptography” teaches the mathematical foundations for the cryptographic algorithms and cryptographic protocols used in other courses such as “Information Security” or “Network Security”. In particular, the course treats symmetric encryption schemes, block ciphers and modes of operation, as well as public key encryption schemes and digital signatures. Based on these cryptographic primitives the course will introduce cryptographic protocols for, e.g., secure identification and basic secure computations. The course emphasizes the methodology of “provable security” where security properties first are clearly defined and then based on explicit security assumptions. Furthermore, the limit of this methodology is exemplified with side channel attacks on cryptographic schemes.

Literature
Literature will be distributed with the course materials.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.4

5.4.3 Network Security

Course Name			
Network Security			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Security and Privacy Engineering	Prof. Dr. Thorsten Strufe
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6

Overall Course Objectives
Participants will learn to assess privacy and network security threats, and how they can be solved or mitigated. They will understand the necessary background on networking, as well as which metrics and methodologies exist, and how they are used.
Learning Targets
Participants ▪ Can explain the basic networking functionality, including routing and name services ▪ Can outline common network security threats and goals, and describe methods for security analyses ▪ Understand the common attacks on routing, naming, denial of service ▪ Can distinguish protocol designs regarding typical vulnerabilities and known secure concepts
Course Content
The course presents background on resilience in general, the necessary foundations in network and graph theory, as well as cryptography. A basic introduction of the relevant network protocols (IP, TCP, IPsec, TLS, BGP, DNS) follows, as well as discussions about their known vulnerabilities and concepts or protocols for protection.
Literature

Literature will be distributed with the course materials.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.4.

5.4.4 Data Protection Regulations

Course Name			
Data Protection Regulations			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Security and Privacy Engineering	Prof. Dr. jur Franziska Böhm
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6
Overall Course Objectives			
Knowledge on important data protection principles, case-law and legal foundations of privacy and data protection			
Learning Targets			
Participants ▪ gain knowledge of fundamental characteristics of data protection regulations, e.g. GDPR ▪ gain knowledge of fundamental characteristics of data protection case-law ▪ gain the ability to detect data protection shortcomings in software design			
Course Content			
The data protection course deals with recent case-law and legal foundations of privacy and data protection and gives an overview of the most important data protection principles to be respected in software development, privacy by design solutions and privacy by default. Although legal requirements are the main topic, examples for the implementation of data protection principles in technical solutions are given.			
Literature			
Literature will be distributed with the course materials.			
Prerequisites for participation in course			

No prerequisites required.
Modality of Exam
See 5.4.

5.4.5 Emerging Technologies and Critical Infrastructures

Course Name			
Emerging Technologies and Critical Information Infrastructures			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Security and Privacy Engineering	Prof. Dr. Ali Sunyaev
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 24h, hereof 7,5h contact hours 16,5h homework and self-studies	0,8

Overall Course Objectives

Critical information infrastructures (CII) are sociotechnical systems comprising essential software components and information systems with pivotal impact on individuals, organizations, governments, economies, and society. We already rely on diverse CII in our daily lives, for example, for efficient water and energy distribution (e.g., Industrial Automation and Control Systems), messaging (e.g., WhatsApp), managing businesses (e.g., SAP Hana), and playing games online (e.g., GamingAnywhere). CII have also powered other key digital trends including mobile computing, the internet of things, big data, and artificial intelligence, thereby, accelerating industry dynamics, disrupting existing business models, and fueling the digital transformation. Today, CII impact almost every aspect of our everyday lives and they will continue to transform the world we live in various ways on multiple and international levels. Nevertheless, CII require careful design, development, and evaluation to ensure reliable, secure, and purposeful operation.

This course features a strong focus on different subject areas related to CII, including, but not limited to, internet technologies, health care, and information privacy. The course not only introduces participants to CII in general and related domains but also allows to gain hands-on experience in this interesting topic area by jointly examining use cases.

Learning Targets

Participants

- have foundational knowledge about the design and operation of critical information infrastructures and related Internet technologies
- can distinguish between the challenges and opportunities of critical information infrastructures in different domains
- have principal understanding of the distributed ledger technology and its concepts like blockchain (e.g, bitcoin) and TDAG (e.g., IOTA)
- can evaluate and improve sociotechnical systems based on Internet technologies
- combine theoretical and practical contents of the courses in the module to solve existing problems in the domain of critical information infrastructures

Course Content
In the first session, the course tackles several topics in the domain of critical information infrastructures, including, but not limited to, ▪ Foundations of critical (information) infrastructures ▪ Internet technologies as backbone for critical information infrastructures ▪ Distributed Ledger Technology Designs ▪ Trade-offs by using Blockchain as an infrastructure for management of data and processes ▪ Functions of critical information infrastructures ▪ Challenges of critical information infrastructures ▪ Management of critical information infrastructures ▪ Critical information infrastructures in the wild: major and famous issues The following session will focus on an in-depth exploration of selected use cases that represent current challenges in research and practice. For example, participants will learn how to continuously monitor and audit critical information infrastructures to ensure reliability and security.
Literature
Relevant literature and selected case studies will be provided throughout the course. For further reading, the following articles are recommended: ▪ Dehling, T., Lins, S., & Sunyaev, A. (2019). Security of Critical Information Infrastructures. In: C. Reuter (Ed.) Information Technology for Peace and Security. Springer Wiesbaden. DOI: 10.1007/978-3-658-25652-4_15 ▪ Kannengießer, N., Lins, S., Dehling, T., & Sunyaev, A. (2019). What Does Not Fit Can be Made to Fit! Trade-Offs in Distributed Ledger Technology Designs. In: Proceedings of the 52nd Hawaii International Conference on System Sciences (IEEE HICSS 2019). https://www.researchgate.net/publication/327793246_What_Does_Not_Fit_Can_be_Made_to_Fit_Trade-Offs_in_Distributed_Ledger_Technology_Designs ▪ Lins, S., Schneider, S., & Sunyaev, A. (2018). Trust is Good, Control is Better: Creating Secure Clouds by Continuous Auditing. IEEE Transactions on Cloud Computing, 6(3), 890–903. https://doi.org/10.1109/TCC.2016.2522411 ▪ Adelmeyer, M., & Teuteberg, F. (2018). Cloud Computing Adoption in Critical Infrastructures -Status Quo and Elements of a Research Agenda. In MKWI 2018 Proceedings (pp. 1345–1356). Lüneburg, Germany. ▪ Dehling, T., & Sunyaev, A. (2014). Secure Provision of Patient-Centered Health Information Technology Services in Public Networks—Leveraging Security and Privacy Features Provided by the German Nationwide Health Information Technology Infrastructure. Electronic Markets, 24(2), 89–99. https://doi.org/10.1007/s12525-013-0150-6 ▪ Rinaldi, S. M., Peerenboom, J. P., & Kelly, T. K. (2001). Identifying, Understanding, and Analyzing Critical Infrastructure Interdependencies. IEEE Control Systems Magazine, 21(6), 11–25. https://doi.org/10.1109/37.969131
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.4.

5.5 Digital Services (Elective Focus Area 1)

Module Name			
Digital Services			
Semester	Subject	Module Supervisor	Credit Points for Module
3	Engineering	Prof. Dr. Gerhard Satzger	8

Module Content

Not only do services already account for more than 60% of the gross value added of developed economies: even product companies try to increasingly tap into the application processes of their customers ("servitization"); thus, comprehensive knowledge on how to strategically use, design, engineer, and manage services are key.

In particular, current trends make the familiarity with digital services (that can be rendered across a network) a must for *any* future leader:

1) **Digital nature:** Digital creation and delivery of these services trigger a number of options like immediate globalization capabilities, agile development and deployment (DevOps), simple inclusion of open innovation concepts, or the individualization of delivered solutions.
2) **Data & analytics:** Availability of "big data" (e.g., created via sensors or social media) and sophisticated AI-based analytics enable to build customer intimacy, to improve internal efficiency as well as to augment or completely innovate customer offerings.
3) **System & platform perspectives:** The notion of service (eco)systems connected via digital services opens up a variety of innovation options in inter-organizational or co-opetitive business models ("smarter systems", e.g. in supply, health care, mobility or energy systems).

The module equips future leaders with a fundamental understanding of and a methods-/toolbox for driving innovation in digital services and for adapting service strategies, service design and service management. It particularly focuses on the user-centric design of new services as well as on the use of data and AI – both in technical terms to create analytics solutions and in economic terms to drive business model transformation.

Individual course parts:

- Service Innovation – (2.5 days)
- Service Design Thinking (2.5 days) – incl. Workshop
- Digital Service Business Models and Transformation (2 days)

Artificial Intelligence in Service Systems (3 days) – incl. Workshop

Learning Results (LR)

LR-1: Participants understand different perspectives on services and value creation

LR-2: Participants master concepts and methods to drive innovation via digital services

LR-3: Participants be familiar with and be able to apply design thinking methodology to innovate in services

LR-4: Participants understand patterns of data based services and corresponding business model innovations

LR-5: Participants know and apply AI/ machine learning concepts to deriving value from data

Workload

Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).

Controls of Success In EM 5-1 (5.5)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.5.1 Service Innovation	Written examination and case study	Written examination with a duration of 60 minutes. Case Study presentation with approx. 10 minutes per participant	None	At the end of the module	Yes
5.5.2 Service Design Thinking					
5.3.3 Digital Service Business Models and Transformation					
5.5.4 Artificial Intelligence in Service Systems					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.5.1 Service Innovation

Course Name			
Service Innovation			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Elective	Digital Services	Prof. Dr. Gerhard Satzger
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6
Overall Course Objectives			
The course familiarizes students with different service concepts as well as methods and tools to create innovation via (digital) services.			
Learning Targets			
Participants • Are familiar with servitization trends and drivers as well as novel service science concepts • Understand innovation definitions and patterns (e.g. architectural innovation) and know the particularities of digital services			

- Know and are able to apply a set of methods and tools to identify innovation targets, to design innovative solutions and to collaborate on innovation
- Understand bounded rationality and human behavior as impediments of innovation

Course Content

Concepts
- Basics of Innovation, Services, Service Systems
- Innovation Types
- Innovation Challenges in Services
- Innovation Processes and Diffusion

Methods and Tools
- Technology and Strategic Foresight
- Service Design Thinking
- Collaborative Innovation
- Creativity

Innovation in Practice
- Resistance
- Start-up Experiences

Literature

- Böhmann/Leimeister/Möslein (2014), Service Systems Engineering : A Field for Future Information Systems Research. Business & Information Systems Engineering, 6 (2), 73-79.
- Cardoso et al. (eds.) (2015), Fundamentals of Service Systems, pp. 1-32, Heidelberg
- Christensen (1997), The Innovator's Dilemma. When New Technologies Cause Great Firms to Fail.
- Christensen/Raynor/McDonald (2015), What is Disruptive Innovation, HBR, Dec.
- Ostrom et al. (2015), Service Research Priorities in a Rapidly Changing Context, Journal of Service Research, 18(2), 127-159

(detailed literature recommendations for specific parts are given within the lectures)

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.5.

5.5.2 Service Design Thinking

Course Name

Service Design Thinking

Semester	Module Type	Allocated to the following Module	Lecturers

3	Elective	Digital Services	Dr. Niels Feldmann
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 57,6h, hereof 18h contact hours 39,6h homework and self-studies	1,92

Overall Course Objectives

The course introduces the students to the concept of the Design Thinking approach and its application for innovating digital services. For this, the course is taught by alternating lectures and practical exercises. The exercises center around a small real-world innovation challenge.

Learning Targets

Participants

- understand the importance, advantages and limitations of a human-centered innovation approach
- are familiar with the design thinking process in general, and the role of need finding and prototyping in particular
- understand the specifics of service design thinking
- build up a broad spectrum of design thinking specific tools and techniques
- gain practical experience by applying the design thinking approach to service innovation challenge

Course Content

Service Design Thinking

- Historical perspective on design thinking
- The general Design Thinking idea
- The Design Thinking micro-cycle and macro process
- Service specifics to Design Thinking

The Design Thinking micro cycle

- (Re-)Defining the service design challenge
- Needfinding and expertizing
- Ideation and creativity
- Prototyping and testing services

The Design Thinking macro process

- Phase of the design thinking macro process and their specific roles
- In-depth: Critical function and critical experience prototypes
- In-depth: Dark horse prototypes
- In-depth: Funky and functional prototypes

Practical Exercises: A small service innovation challenge gets solved by applying the design thinking approach.

Literature

- Feldmann/Cardoso (2015), Service Design. In: Cardoso et al. (eds), Fundamentals of Service Systems. Service Science: Research and Innovations in the Service Economy. Springer
- Lewrick/Link/Leifer (2018), The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems, Wiley

- Stickdorn/Schneider (2012) This is service design thinking: basics, tools, cases. Wiley, New York
- Uebernickel/Brenner/Pukall/Naef/Schindlholzer (2015) Design Thinking: Das Handbuch. Frankfurter Allgemeine Buch, Frankfurt am Main

(detailed literature recommendations for specific parts are given within the lectures)

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.5.

5.5.3 Digital Service Business Models and Transformation

Course Name

Digital Service Business Models and Transformation

Semester	Module Type	Allocated to the following Module	Lecturers
3	Compulsory (course is assigned to student by examination board)	Digital Services	Dr. Ronny Schüritz
Recurrence	**Mode of Teaching**	**Workload**	**Credit Points for Course**
Each winter semester	Lectures and exercises	Total 72h, hereof 22,5h contact hours 49,5h homework and self-studies	2,4

Overall Course Objectives

The course introduces the students to the concept of business models as well as the organizational transformation required to deliver novel digital services.

Learning Targets

Participants

- are familiar with the concept of the business model and are able to apply practical tools and frameworks
- understand the specific challenges and managerial requirements for providing a service offering
- learn about the design of digital and analytics-based services
- understand the required digital transformation and learn about the organizational changes and challenges
- are able to determine a strategic pathway for a company and understand its implications

Course Content

Service Business Models

- Business Model Theory and Tools
- Service Business Models

- Service management and Transformation (Servitization)

Digital Services and Transformation

- Digital Economy and Digital Services
- Digital Business Models and Digital Platforms
- Digital Transformation Pathways and Organizational Changes

Analytics-based Digital Services and Transformation

- Data-Driven Decision Making
- Data-Driven Business Models and Analytic-based Services

Literature

- Weil/Woerner (2018), What's your digital business model? Harvard Business Review Press.
- Schüritz/Seebacher/Schwarz/Satzger (2017), Datatization as the Next Frontier of Servitization – Challenges of the Organizational Transformation, Proceedings of the International Conference on Information Systems (ICIS) 2017
- Lehrer/Wieneke/vom Brocke/Jung/Stefan Seidel (2018), How Big Data Analytics Enables Service Innovation: Materiality, Affordance, and the Individualization of Service, Journal of Management Information Systems, 35:2, 424-460
- Someh/Wixom (2017), Microsoft Turns to Data to Drive Business Success. CISR WP 419

(detailed literature recommendations for specific parts are given within the lectures)

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.5.

5.5.4 Artificial Intelligence in Service Systems

Course Name

Artificial Intelligence in Service Systems

Semester	Module Type	Allocated to the following Module	Lecturers
3	Compulsory (course is assigned to student by examination board)	Digital Services	Dr.-Ing. Niklas Kühl
Recurrence	**Mode of Teaching**	**Workload**	**Credit Points for Course**
Each winter semester	Lectures and exercises	Total 62,4h, hereof 19,5h contact hours 42,9h homework and self-studies	2,08

Overall Course Objectives

Many novel digital services rely on analytical capabilities that are provided by Artificial Intelligence (AI) and Machine Learning. As part of this course, students pursue the complete lifecycle of an AI-based analytical service with a focus on supervised machine learning challenges. In particular, we focus on analytical services in "service systems", requiring the collaboration of

several elements (e.g. companies). Ample practical work provides a hands-on experience in developing concrete analytics-based digital services.
Learning Targets
Participants ▪ understand the importance of analytics (supported by AI and Machine Learning) for digital services ▪ comprehend the notion of service systems and business networks ▪ understand the importance and the means of applying AI and Machine Learning within service systems ▪ are able to comprehend and implement the complete lifecycle of a typical Artificial Intelligence use case with supervised machine learning ▪ gain an understanding of analytical collaboration between independent entities and how they can derive insights. ▪ are familiar with the concepts of system-wide learning, transfer machine learning, meta machine learning, and concept drift ▪ are proficient with basic, typical Python code for AI challenges.
Course Content
▪ Motivation, Terminology, Overview ▪ Learning along a Digital Service Lifecycle o Initiation o Performance estimation & evaluation o Deployment o Concept drift ▪ Learning in Service Systems: o Meta Learning o Transfer Learning ▪ Ethics of AI
Literature
▪ Russell/Norvig (2015), Artificial Intelligence: A Modern Approach ▪ Kuhn/Johnson (2013), Applied predictive modeling (Vol. 26) ▪ Hirt/Kühl/Satzger (2017), An end-to-end process model for supervised machine learning classification: from problem to deployment in information systems, Proceedings of the DESRIST 2017 Research-in-Progress ▪ Kurzweil (2011). The Singularity Is Near: When Humans Transcend Biology (detailed literature recommendations for specific parts are given within the lectures)
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.5.

5.6 Autonomous Robotics (Elective Focus Area 2)

Module Name			
Autonomous Robotics			
Semester	Subject	Module Supervisor	Credit Points for Module
3	Engineering	Prof. Dr.-Ing. Kai Furmans	8

Module Content
Design and Operation of Autonomous Robots and related systems for applications in production and logistics. Cyber-physical Systems are an important contribution to modern concepts of industrial technology (for instance Industry 4.0, IoT, Industrial Internet). The module uses mobile robots as a platform for the introduction into the relevant methodologies, algorithms and technologies. In a combination of teaching of theory, motivation by contributions of practitioners and an emphasis on experimental lab work the participants will acquire the skill related to the implementation of the basic concepts of autonomous robotics.
Learning Results (LR)
LR-1: Methods of localization and navigation of robots can be described and applied. LR-2: Application and training in artificial neuronal networks for object classification. LR-3: Control of robots and communication with sensors, devices and other robots using ROS and cloud services. LR-4: Evaluate the capabilities and performance of a self-designed and operated robot-system.
Control of Success
A case study is solved in teamwork in a lab, the concepts and implementations have to be defended by the teams and individual discussions challenging the reasoning of the participants will be conducted.
Workload
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).

Controls of Success In EM 5-2 (5.6)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.6.1 Autonomous Robotics Lab	Examination of another kind	Group presentations of lab results during lectures	None	During the module	Yes
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.6.1 Autonomous Robotics Lab

Course Name			
Autonomous Robotics Lab			
Semester	Module Type	Allocated to the following Module	Lecturers
3	Compulsory (course is assigned to student by examination board)	Autonomous Robotics	Prof. Dr.-Ing. Kai Furmans Prof. Dr.-Ing. Christian Wurll Prof. Dr.-Ing. habil. Björn Hein Dr.-Ing. Andreas Trenkle M. Sc. Jonathan Dziedzitz M. Sc. Patric Hopfgarten
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Integrated lectures, exercises and lab	Total 240h, hereof 75h contact hours, 165h homework and self-studies	8

Overall Course Objectives

Design, build and operate cognitive and cooperating robots which interactively solve problems from production and logistics.

Learning Targets

Participants

- are able to describe and use parametrize methods for localization and navigation.
- are able to use and train artificial neuronal networks for object classification and understand and apply the concept of transfer learning in vision-based applications.
- are able to control robots and use communication with sensors, devices and other robots by using ROS and cloud services.
- are able to evaluate the capabilities and performance of a self-designed and operated robot-system.

Course Content

- Algorithms and equipment for localization and navigation.
- Introduction to path planning algorithms.
- Basics of machine learning and their application on vision-based object classification.
- Transfer learning in vision-based applications.
- ROS
- Synchronous and asynchronous communication within and between robots.
- Robot control.
- Task planning – centralized and decentralized cooperative.
- Performance analysis of material handling system.

Literature

Anis Koubaa, Robot Operating System (ROS), Springer, 2016
Prerequisites for participation in course
Fundamentals in programming, mathematics and stochastics.
Modality of Exam
See 5.6.

6 Master Thesis Information Systems Engineering and Management

The Master Thesis can be performed either as a research project in one of the institutes at the KIT or in cooperation with the participant's company. In the latter case it should be performed under the supervision of an advising faculty member from the HECTOR School.

The following table (Tab. 6-1) summarizes the Master Thesis scope and process:

Content	The scope of the Master Thesis should contain the following criteria: ▪ description of the problem ▪ review of the relevant literature (state of the art) ▪ definition, selection and description of suitable approaches ▪ execution of the necessary work schedule (experiments, statistical analyses) ▪ derivation of a conclusion ▪ discussion of validity, scope and verification
Learning Targets/ Skills	Participants demonstrate the skills to independently solve a scientific problem adapting methods and models acquired during participation in the modules 1-10.
Pre-Requisites	Successful completion of 80% of the modules and exams.
Workload	The Master Thesis is to be completed within a period of 6 months. Start of the Master Thesis is the 1st day of the following month after the 8th HECTOR School module.
Master Thesis Operations	1. Orientation Phase: Until module 6 the participants are asked to search for a project within their professional environment. Along with this, they are also asked to search for a first supervisor within the lecturers of the HECTOR School. 2. Registration Phase: The participants are asked to hand in the official Master Thesis application form with an outline of the Master Thesis topic and signed by the chosen first supervisor to the student office of the HECTOR School until the end of module 8. The participant then receives the approval by the study regulations committee. 3. Project Phase: The project phase starts with the 1st of the following month after the 8th HECTOR School module. During the project phase the participants are asked to follow a milestone plan, which is agreed on with their supervisor. The participants regularly report about their progress to the HECTOR School. Before the final submission, the students will hold official colloquia, where they are asked to present the contents of their Master Thesis in a 20 minutes colloquium using modern media. The colloquia dates are usually set around 4 weeks before the official submission date. 4. Submission Phase: The participant is asked to hand in two paper copies and a digital version on CD or data stick to the student office by the announced completion date. Templates and style formats will be communicated by the HECTOR School.

Tab. 6-1 Master Thesis scope and process

Further information on the Master Thesis regulations can be seen in the General Study and Examination Regulations, § 14 (see also Chap. 8.4.).

7 Karlsruhe Institute of Technology (KIT)

On October 01, 2009, the Karlsruhe Institute of Technology (KIT) was founded by a merger of Forschungszentrum Karlsruhe and Universität Karlsruhe. The basis was the KIT Merger Act that was adopted unanimously by the Baden-Württemberg state parliament in July 2009. KIT bundles the missions of both precursory institutions: A university of the state of Baden-Wuerttemberg with teaching and research tasks and a large-scale research institution of the Helmholtz Association conducting program-oriented provident research on behalf of the Federal Republic of Germany. Within these missions, KIT is operating along the three strategic fields of action of research, teaching, and innovation.

With roundabout 9450 employees and an annual budget of about EUR 850 million, one of the largest research and teaching institutions nationwide is established in Karlsruhe. It has the potential to assume a top position worldwide in selected fields of research. The objective: KIT will become an institution of top research and excellent scientific education as well as a prominent location of academic life, life-long learning, comprehensive advanced training, unrestricted exchange of know-how, and sustainable innovation culture.

7.1 *Department of Mechanical Engineering*

Production Technology: Taking an integrated approach

The holistic treatment of products and production in an international environment is central to industrial engineering research projects at Karlsruhe; included in this is not only manufacturing itself, but also operation, maintenance and recycling. The opening of national borders for industries results in the necessity to reduce development times and in turn increase the application of technical models and computational simulations.

Research at Karlsruhe in production focuses on taking an integrated approach to the product and the production within an international context. It is not restricted to the process of production alone, but also includes aspects such as plant operation, maintenance and recycling. Another aspect is the increasing pressure to intensify automation. Research and teaching at the Department's production-technology oriented institutes cover almost every phase of the product life cycle. Research includes issues such as product planning, design, production planning, manufacturing and assembly, quality management, material flow technology and logistics as well as industrial management and ergonomics.

Product Development and Design: The creative element

Product Development and Design have the goal of examining and developing a theoretical basis for methodical development processes including the respective computing systems (CAD/CAM). Taking traditional design methods as a starting point, researchers use an integrated approach to accompany and systematically manage the entire product development and production process. Complex product development and production tasks are solved in close cooperation with industry. In doing so the focus is on the entire development chain – from environmentally compatible and strategic product planning

brainstorming all the way to creating complete three dimensional CAD designs is focused on. Simulations and prototype construction are also part of the process. Other research areas include:

- Energy and environment – developing sustainable technology
- Material Technology – enabling innovative engineering
- Microsystem technology- large impact from small devices
- Mechatronics – a symbiosis of two technological worlds
- Vehicle and powertrain technology – the motors of a mobile society
- Theoretical basics – the foundations of engineering

7.2 *Department of Economics and Business Engineering*

Research and teaching in the Department of Economics and Business Engineering at Karlsruhe is distinguished by interdisciplinary networked tasks and a focus on current developments. The faculty is the largest training center for graduate industrial engineers in Germany.

The interdisciplinary course in industrial engineering with business studies has characteristics that are typical for Karlsruhe Institute of Technology (KIT): it is geared towards quantitative problems and is therefore strongly method-orientated; it also includes applied computer science. Working in an interdisciplinary network, perhaps taking both economic and technical aspects into account at the same time, is essential for the design, manufacture and marketing of products.

Interdisciplinary research

Despite the large number of resources devoted to teaching at the institutes, research is still very much a priority. The interdisciplinary Research Training Group “Market Engineering” recently founded bridges the gap between education and research. The program is devoted to designing institutions, services, systems and social models for electronic markets while taking into account all of the economic, technology-based and legal aspects.

The main fields of research include:

- Finance and capital market research
- Marketing and market research
- Mapping work processes using computer science
- Information management
- Production and materials flow management
- Ergonomics
- Sustainable construction

- Traffic prediction and transport network planning
- System dynamics and innovation
- Optimization, resource management and risk management
- Actuarial science and applied risk science
- Welfare economics
- Experimental economic research

7.3 *Department of Computer Science*

Without the use of computers hardly anything in our society would function. Whether in transportation, production, administration, health care or leisure, computers unobtrusively complete increasingly important tasks. As a result, information technology has become an extremely significant sector. The Universität Karlsruhe (TH) was the first German university to offer a full Diploma degree in computer science in 1972. Ever since then, the Department of Computer Science is considered a leader in the field and internationally ranked number one in all the major rankings and evaluations.

Research and education in computer science at the Karlsruhe Institute of Technology (KIT) is characterized by its breadth coupled with a strong focus on theoretical and practical aspects of computer science. The value that the faculty places on multi-disciplinary education is shown by the offer of business informatics degree program. Other fields of research include:

- The applications of computer science: computer-aided surgery
- Semi-humanoid robot systems
- Computers for everyday use

7.4 *Department of Electrical Engineering and Information Technology*

Its 15 institutes – including two interdepartmental research centers – and approximately 1500 students put the department in the very heart of engineering at the Karlsruhe Institute of Technology (KIT). By focusing on automation, energy, information and communication technology and electronic components and circuits, the faculty puts students in touch with all of the cutting-edge areas of electrical engineering and information technology.

The demand for components and systems for the fast transfer, storage, visualization and processing of information is steadily increasing. Hybrid and quantum components and molecular electronics result in completely new possibilities for future information processing and storage.

Microelectronic and nanoelectronic components also enable the so-called System on Chip (SoC): the integration of complete microelectronic systems onto a single silicon chip has become feasible through

the rapid development of CMOS VLSI technology. This demands cost-effective technology, application specific hardware/software architectures and highly efficient design methods. Other research areas include:

- Mechatronics – new functions through interdisciplinary research
- Energy at the cross roads of ecology and economics
- Fuel cells: a technology for the future
- Wireless communication: effective planning of transmitter networks
- Systems engineering: personal health monitoring
- Aviation and aeronautics
- Microelectronics, nanoelectronics and optoelectronics

7.5 Department of Chemical Engineering

The Department of Chemical Engineering and Process Engineering at the KIT with 12 chairs at 6 institutes and about 1000 students is one of the world's largest in their field of study. Chemical Engineers have been educated successfully in Karlsruhe since 1928. The traditional courses chemical engineering and process engineering were complemented by the bioengineering program in 2001. All three courses have steadily increasing intake and graduate numbers.

Chemical engineering, process engineering and biological engineering are interdisciplinary engineering sciences connecting the fields of engineering, technical physics, mathematics, and chemistry. The focus of research and teaching at the faculty is in the three general themes material process technology, biotechnology and food technology, energy and environmental technology.

7.6 Department of Civil Engineering, Geo and Environmental Sciences

At the beginning of the foundation of the University of Karlsruhe stood the engineer Johann Gottfried Tulla. In 1807 he founded an Engineering School in order to educate employees for the administration of Highway Building and Hydraulic Engineering, which was organized by him. An architect joined this project: Friedrich Weinbrenner, his Building School arose from the Architectural Drawing School, which existed since 1787. The union of Tulla's Engineering School and Weinbrenner's Building School with the Academy of Machine Construction of Freiburg and a School of Forestry gave rise to the foundation of a Polytechnic School in 1807. It achieved academic quality and was called "technical academy. Tulla, the principal of the highway building and hydraulic administration of Baden County had already intensely prepared the project. In Paris short after Napoleon's coup d'état he had got to know the Polytechnic University of Ecole – the University, which at first gave its students a basic scientific education, before it specialized the prospective engineers in their future profession.

Today both the traditional acquiring of basic scientific knowledge and accomplishing of applied scientific work are regarded as equally important at the University Fridericiana, how the university is called since 1902. And Tulla's special field of activity - the regulation of the Rhein is still researched today. Since 2002 Geo- and Environmental Sciences and the Civil Engineering work together within this department. Thus the dovetail connection and interaction of building structures and their environment and the study of intervention/interference in the city and cultivated landscape are accommodated during the education and research.

8 Appendix

8.1 European Credit Transfer and Accumulation System

8.1.1 What is the ECTS (European Credit Transfer System)?

The European System for calculating, assessing and accumulating student performance is a system specifically designed for students. It is based on the workload that the student must complete in order to achieve the objectives of the program of study. These objectives are primarily defined in the form of learning outcomes and the competencies that are to be acquired in the course of study.

8.1.2 What are the primary aspects of ECTS?

The ECTS is based on the general understanding that the workload for a full-time student during an academic year corresponds to a total of 60 ECTS-credits. That means that the workload for a full-time student studying in Europe comprises 1500-1800 working hours per year in most cases. For our part-time program the workload consists of 90 ECTS for the whole program which is effectuated in approximately 1,5-2 academic years.

- The workload in ECTS consists of the time that a student requires to complete a variety of learning activities, such as attending lectures and seminars (contact hours), self-study, project work, exam preparation, etc.
- Credits are assigned to all components of a program of study (e.g. modules, courses, laboratories, final project, etc.) and indicate the workload of each component in relation to the total workload that would be required in one full year of study in the appropriate program of study.
- The learning results are a set of competencies, which indicate what the students should know, understand, and be able to do at the end of a short or long learning process. Credits in ECTS are awarded to students only after the course has been completed and a corresponding evaluation of the desired learning results has been made.
- The assessment of student performance is documented via the commonly-used grading system for each local/national region. It is good practice, especially in the case of credit transfers, to include an ECTS grade. The ECTS grading scale ranks students based on a statistical distribution. Thus, statistical data on student performance is a necessary prerequisite for applying the ECTS grading scheme. Successful students can obtain the following grades: A for the best 10%, B for the next 25%, C for the next 30%, D for the next 25%, E for the next 10%. Unsuccessful course performance receives a grade F. The transcript of records need not specify the number of failed attempts.

8.2 Quality Management

The HECTOR School of Engineering and Management guarantees for the quality and continual improvement of the curriculum. A number of tools are used in order to ensure the high academic and pedagogic standards defined by their members.

8.2.1 Course evaluation

After each module a written questionnaire is distributed to the participants on which they can evaluate the quality of the lectures. The main topics are:

- lecture content
- practical applicability
- interference/overlap with other lectures
- relationship/link to preceding lectures
- speed of material presentation
- extension of the lecture material
- usefulness/relevance of lecture notes
- audibility of lecturer
- blackboard, transparency structure
- preparation of lecturer
- presentation style and motivation
- willingness to answer questions

After each module the returned questionnaires are analyzed and published on the SharePoint of the HECTOR School and are discussed with lecturers and participants.

8.3 Admissions Regulations

The official " Satzung für den Zugang zu dem weiterbildenden Masterstudiengang Information Systems Engineering and Management am Karlsruher Institut für Technologie" can be found here

https://www.sle.kit.edu/amtlicheBekanntmachungen2010-2019_8986.php

A translated version of the "Admission Regulations" can be found on the SharePoint of HECTOR School.

8.4 General Study and Examination Regulations

The official "Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für die weiterbildenden Masterstudiengänge Information Systems Engineering and Management and Financial Engineering" can be found here

https://www.sle.kit.edu/amtlicheBekanntmachungen2010-2019_8992.php

A translated version of the "General Study and Examination Regulations" can be found on the SharePoint of HECTOR School.

8.5 Fees Regulations

The official "Satzung des Karlsruher Instituts für Technologie (KIT) über die Studiengebühren für die weiterbildenden Masterstudiengänge Mobility Systems Engineering & Management, Energy Engineering & Management, Financial Engineering, Management of Product Development, Production and Operations Management, Information Systems Engineering and Management" can be found here http://www.sle.kit.edu/amtlicheBekanntmachungen2013.php

A translated version of the "Fees Regulations" can be found on the SharePoint of HECTOR School.