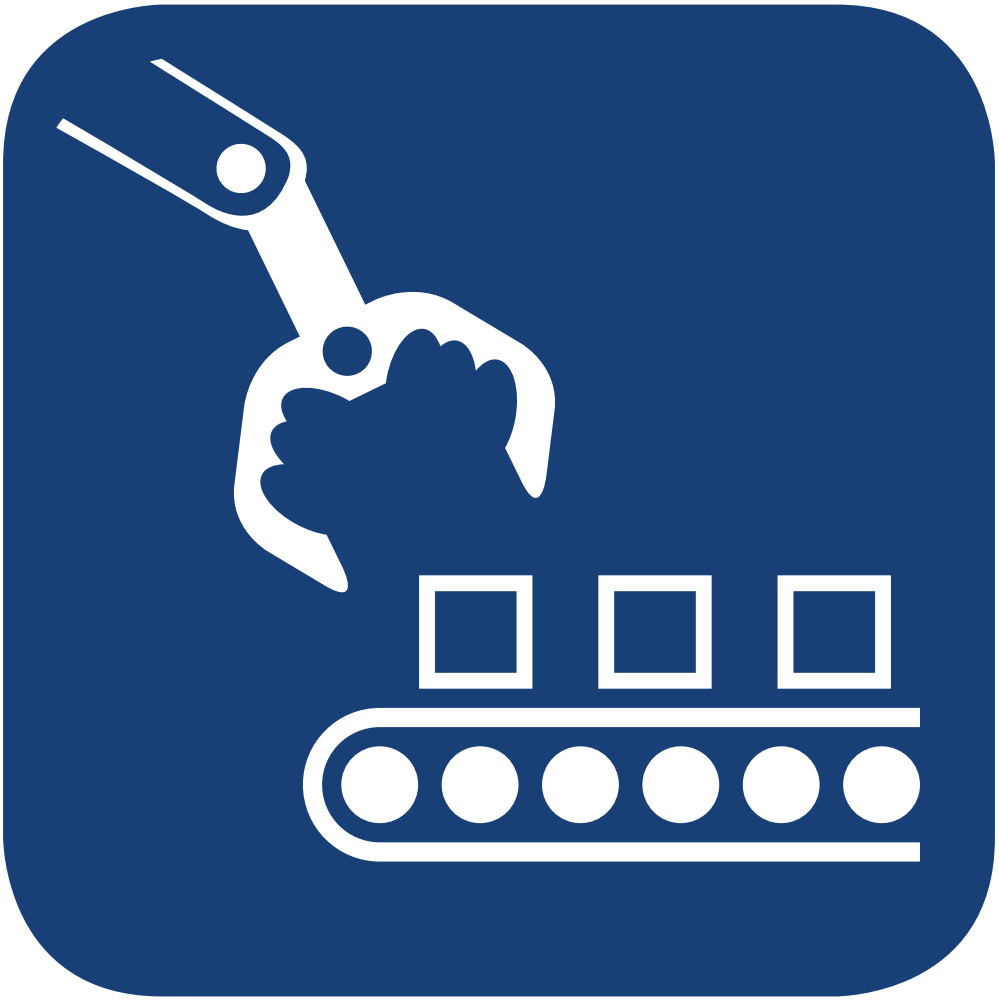
HECTOR SCHOOL
Technology Business School of the KIT

Karlsruher Institut für Technologie



Course Guide Book Intake 2020/2021

Executive Master Program
Production & Operations Management

Contents

Contact & Imprint

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Curriculum may be subject to change.

1 Foreword

Added value of a Master of Science in "Production and Operations Management" for prospective executives

In an increasingly competitive environment where the quality of a product is on an equally high level and innovations are disseminating ever faster, a key to success of business units in service and production is the efficiency of the value creating process. Globalization and the closer interaction of partners in the value creating chain are options for improvement of the currently established business processes. A big challenge is the strive for global optimum of the value creating chain while maintaining local responsibility for execution, reliability and quality.

The Executive Master Program of Production and Operations Management (POM) provides the necessary knowledge methods and tools to understand and improve the operation of production and service units by creating appropriate and best-in-class business processes. Since in production and logistics the flow of data, products and money are closely linked, causes on the modules of POM deal with all these three factors. Human resources management is vital to achieve the manageability of those processes, which are needed to set up and operate network and systems that combine data money and material into a product.

Project Management on a global scale in particular in multi project environment is a necessary tool to set up and improve operations and structures. The optimization and sizing of the necessary structures for production, warehousing, transportation and information processing is based on mathematical modeling and data exploration. Necessary fundamentals are subject of the courses in operations research. All the above topics are covered in the POM by linking concepts and models in case studies to the experience of participants. The interdependencies of the necessary functions in the supply chain will be constantly addressed throughout the program, bringing everything together in an interdisciplinary, final case study, which will top of the teaching program, preparing you for your Master thesis. People with experiences in production, services, especially logistics, will gain extensions of their professional skills enabling them to understand and manage value creating chains, connecting business units and companies on a higher level of profitability and long term customer satisfaction.

Prof. Dr.-Ing. Kai Furmans

Program Director of Production and Operations Management

2 Program Directors

Title/Name	Prof. Dr.-Ing. Kai Furmans	
Phone	+49 (0)721 608-48600	
E-Mail	***Kai.Furmans@kit.edu***	
Affiliation	Institute for Conveying Technologies and Logistics, Karlsruhe Institute of Technology (KIT) Fritz-Erler-Str. 1-3, 76133 Karlsruhe, Germany	
Current Position	Director of the Institute for Conveying Technologies and Logistics Endowed Chair of Logistics H. Hübner Foundation	
Vita	1992 PH. D. (Dr.-Ing.) Universität Karlsruhe (TH) 1996 - 2003 Robert Bosch GmbH, Director of Logistics 2000 Doctorate of Science (Habilitation) Universität Karlsruhe 2003 Appointed Full Professor Karlsruhe Institute of Technology (KIT)	
Fields of Interest	▪ Finite Element Analysis of Material Handling Systems ▪ Enhancement of self-organization in Traffic using I+K support services ▪ Cause and Effect in decentralized supply chains ▪ Simulation and Modeling of Logistic Systems ▪ Distribution Networks ▪ IT-Systems for Logistics	
Memberships & Awards	▪ GOR ▪ VDI: chair of work group “Methods of Modeling”	

Title/Name	Prof. Dr. Stefan Nickel
Phone	+49 (0)721 608-43381
E-Mail	***Stefan.Nickel@kit.edu***

Affiliation	Institute of Operations Research: Discrete Optimization and Logistics, Karlsruhe Institute of Technology (KIT) Englerstrasse 11, 76131 Karlsruhe, Germany
Current Position	Head of the Chair: Discrete Optimization and Logistics at the IOR
Vita	1995-1999 Assistant Professor, University of Kaiserslautern Since 1999 Associate Professor, University of Kaiserslautern 2003-2009 Chair in Operations Research and Logistics, University of Saarbrücken Since 2009 Chair in Discrete Optimization and Logistics, KIT
Fields of Interest	▪ Modelling location decisions in Supply Chain Management ▪ Multi-periodic design and optimization of distribution networks ▪ Optimization methods in in-house logistics ▪ Optimization methods in health care
Memberships & Awards	▪ INFORMS ▪ European Working Group on Locational Decisions (EWGLA) ▪ College on Locational Analysis (COLA) ▪ Gesellschaft für Operations Research e.V. (GOR) ▪ Mathematical Programming Society (MPS)

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 Production and Operations Management

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

1. Using the skills acquired in the Master Program in the area of production management with a special focus on production processes, information technology and logistics, as well as the necessary subject-specific methods and tools, the graduates are able to understand and analyze the processes in production and manufacturing, grasp the requirements and formally describe them, formulate constraints and objectives and implement targeted improvements. For this purpose, they also learn to use methods of simulation.
2. The graduates are able to independently analyze and optimize the efficiency of value-adding processes in connection with the operation of production and service systems.
3. They know current operations management concepts and methods, particularly in the context of decision support and -making, and can use and develop these in a way related to issues.
4. Graduates are able to recognize the possibilities and limits of formal methods and models, as well as the challenges related to the transfer from the model world to reality and are also capable of dealing with them in a solution-oriented way.
5. Since in production and logistics information, means of production and cost effectiveness are closely linked, the graduates can independently optimize problems, taking into account all three factors and using multidisciplinary approaches.
6. Graduates are able to analyze and evaluate technological problems in the context of logistics and production under economics aspects.

7. They are able to thoroughly understand the approach in the internal and external financial reporting and to apply it in the corporate context.
8. Furthermore, they are familiar with approaches to preparing and optimizing a company's strategic decisions.
9. They have mastered the essential skills of project management in an international context and, through their interdisciplinary training, can actively integrate those from various fields, hierarchical levels and cultural backgrounds and thus prepare and implement decisions concerning corporate strategy.
10. They are able to understand marketing, human resource management, and legal issue approaches in the technological context, to recognize and evaluate interconnections and thus, to evaluate the effectiveness of strategies. Based on this analysis, recommendations for action can be derived.

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	Fundamentals in Production and Operations Management	1 Introduction to Industrial Engineering	6
				2. Industrial Services	
				3. Operations Research: Decision Making with Linear Models and Networks	
				4. Information Systems: Fundamentals of Computer Science for Engineers	
	Engineering	EM2	IT Support of Production Systems	1. Information Systems: Product Lifecycle Management	6
				2. Stochastic Models of Manufacturing Systems	
				3. Simulation of Production Systems	
				4. Operations Research: Decision Making with Discrete and Nonlinear Models	
	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	Methods of Operations Management	1. Production Engineering	6
				2. Strategic Supply Network Management	
				3. Human Factors and Ergonomics	
				4. Technologies of Distribution Networks	
	Engineering (elective)	EM4	Networks of Supply and Production Systems	1. Supply Network Management: Inventory Management in an Uncertain Environment	6
				2. Information Technology for Logistic Systems	
				3. Global Production	
				4. Operational and Tactical Network Management	

Semester	Subject	Type of Module	Name of Module	Course	Credits
	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	Global Production and Distribution Systems	1. Quality Management	6
				2. Supplier Management	
				3. Smart Manufacturing and Automation with Industry 4.0	
	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 9 months)		30

Tab. 3-1 Study Plan POM

3.4 Academic Calendar Intake 2020

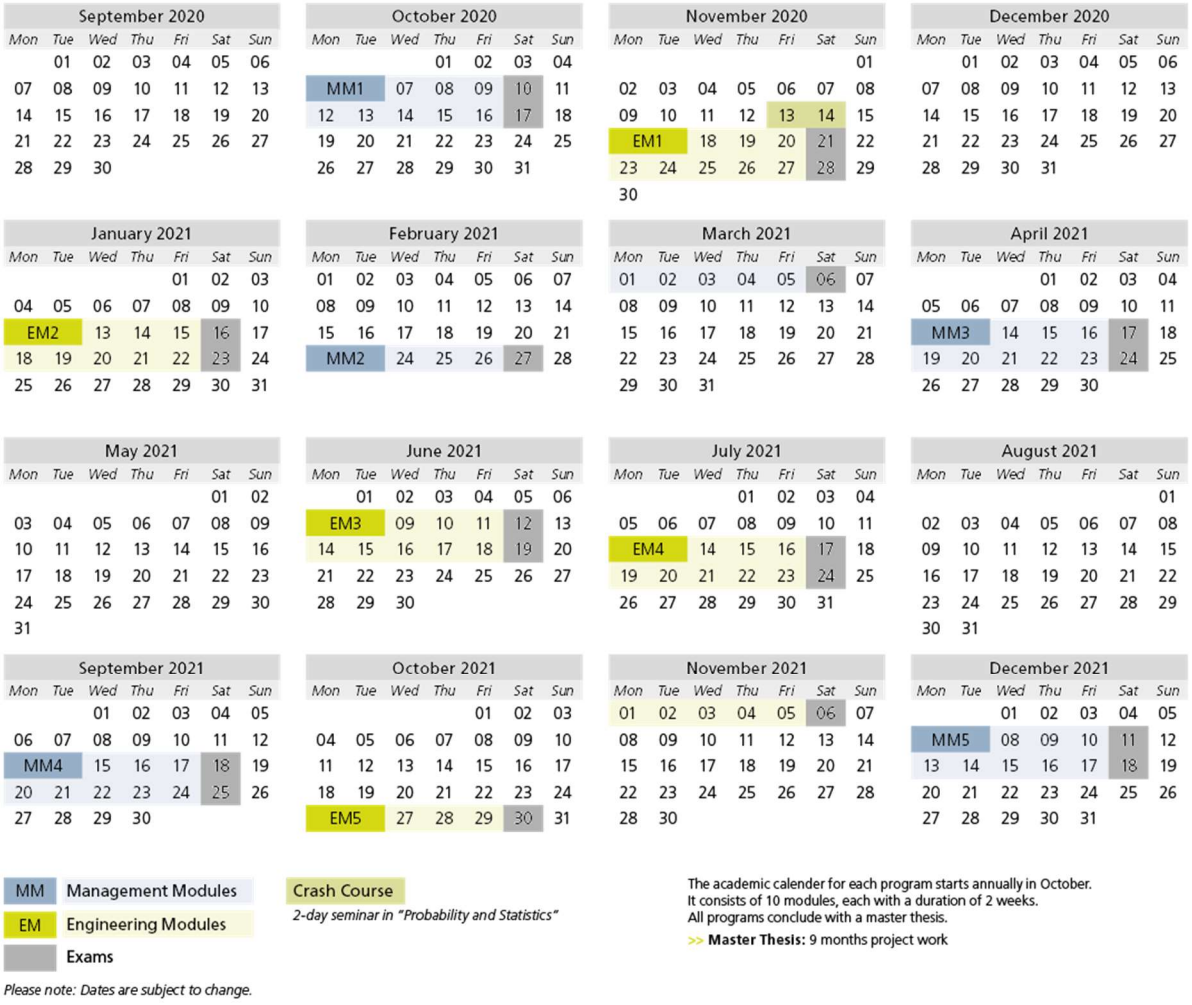

Figure 1: Academic Calendar Intake 2020

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

The Study and Examination Regulations foresee elective focus areas within the subject of Engineering. However, in Production and Operations Management there are no focus areas and the elective modules EM4 and EM5 are identical for all students.

3.5 Teaching Structure

HECTOR School's 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 Engineering 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 Master of Science (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. Stefan Nickel	Institute of Operations Research, 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	
Dipl.-Inform. Abilio Avila	Institute of 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
Prof. Dr. Stefan Morana	Universität des Saarlandes
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 Director	
Prof. Dr.-Ing. Kai Furmans	Institute for Material Handling and Logistics, KIT
Module Supervisors	
Prof. Dr. Oliver Stein	Institute of Operations Research, KIT
Prof. Dr. Dr.-Ing. Dr. h. c. Jivka Ovtcharova	Institute for Information Management in Engineering, KIT
Prof. Dr.-Ing. Kai Furmans	Institute for Material Handling and Logistics, KIT
Prof. Dr.-Ing. Gisela Lanza	Institute of Production Science, KIT
Lecturers in Alphabetical Order	
Tobias Arndt	Global Advanced Manufacturing Institute, China, KIT
Prof. Dr. Hansjörg Fromm	KSRI – Karlsruhe Service Research Institute, KIT
Prof. Dr.-Ing. Jürgen Fleischer	Institute of Production Science, KIT
Prof. Dr.-Ing. Thilo Gamber	Hochschule Ostwestfalen-Lippe
Dr.-Ing. Jan Hrdina	Continental AG
Prof. Dr. Stefan Nickel	Institute of Operations Research, KIT
Prof. Dr.-Ing. Verena Nitsch	RWTH Aachen University
Dr. Sven Spieckermann	SimPlan AG
Mathias Thomas	Dr. Thomas+Partner GmbH & Co. KG

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)			
LR-1: Participants will know how to set up effective information systems LR-2: Participants will know key issues surrounding the analysis of (big) data and machine learning LR-3: Participants will know the boundaries to the use of information and data set by the legal environment LR-4: Participants will know how to create value from information using customer solutions LR-5: Participants will know 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)
LR-1: Participants are able to analyse business environments and to identify and finance value creating business opportunities LR-2: Participants are in a position to implement business opportunities by designing an internal accounting system that coordinates the firm’s business activities LR-3: Participants 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 Presentation	During course	Yes

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

LR-1: Participants know and explain basic modelling techniques for quantitative decision making

LR-2: Participants 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)

LR-3: Participants apply decision support software systems to solve quantitative decision and optimization problems

LR-4: Participants 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	Lecturers
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 examination board)	Strategy and People	Dr.-Ing. Tobias Kunkel
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 Fundamentals in Production and Operations Management

Module Name			
Fundamentals in Production and Operations Management			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Engineering	Prof. Dr. Oliver Stein	6
Module Content			
Industrial management and engineering is of holistic character. So far, industrial engineering has aimed for integrating man, material, equipment, and funds in production systems. Now, activities also focus on the IT and technology infrastructure to control complex systems. Hence, the industrial engineer concept was enlarged from an “efficiency expert” and “productivity expert” by the concept of a “knowledge worker”. Today, industrial engineering also deals with the development, optimization, installation, and management of holistic systems, consisting of man, materials, and infrastructure, for any type of production or service. The module “Fundamentals in Production and Operations Management” enables participants to understand all necessary concepts and underlying methods of industrial management. This module focuses on deterministic and stochastic operations research which is of great help for the planning process of logistic systems (modeling, simulation, etc.) and IT concepts and tools which accompany the Product Life Cycle Management process at the interface of product development and production.			
Learning Results (LR)			
LR-1: Understanding of industrial engineering concepts and analysis of production systems with the help of stochastic models, evaluation based on the characteristics determined. LR-2: Understanding of the relationships in product-related information management systems over the complete product lifecycle. LR-3: Identification of optimization potentials in the production and logistics environment, solution with the help of mathematical formulas, and determination of the quality of the results. LR-4: Analysis of service processes in industrial production by description and modeling with formal methods. On this basis, design of new service processes.			
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 EM 1 (5.1)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.1.1 Introduction to Industrial Engineering	Written examination	60 minutes	None	At the end of the course week	yes
5.1.2 Industrial Services	Written examination	60 minutes	None	At the end of the course week	yes

5.1.3 Operations Research: Decision Making with Linear Models	Oral Examination	Approx. 20 minutes per candidate	None	At the end of the course week	yes
5.1.4 Information Systems: Fundamentals of Computer Science for Engineers	Oral Examination	Oral group examination, approx. 15 minutes per candidate	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 Introduction to Industrial Engineering

Course Name			
Introduction to Industrial Engineering			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	Fundamentals in Production and Operations Management	Prof. Dr.-Ing. Thilo Gamber Dr.-Ing. Jan Hrdina
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44

Overall Course Objectives

"Introduction to Industrial Engineering" is intended as an introductory course for understanding management processes in industry. Many of the topics mentioned in this course appear in the following courses during the major "Production and Operations Management".

Learning Targets

Participants

- gain competencies of basic concepts of Industrial Engineering.
- will learn how to create effective and efficient processes in industry.

Course Content

The course is a general introduction to the operations of an industrial company. It explains major processes of production enterprises. The content of "Introduction to Industrial Engineering" is:

- Objectives and Process Models;
- Market Analysis, Product Design and Production Program

▪ Production Control ▪ Planning of Resources ▪ Quality Management ▪ Product Utilization and Recycling ▪ Design of Manufacturing Systems ▪ Design of Assembly Systems ▪ Maintenance Strategies ▪ Management Systems ▪ Principles of Project Management ▪ Procedures in Factory Planning
Literature
▪ Krajewski, Lee J.; Ritzman, Larry P.: Operations Management. Reading MA: Addison-Wesley Publishing, 2009. ▪ Nahmias, S.: Production and Operation Analysis. New York, NY et al.: McGraw-Hill/ Irvine, 2008. ▪ Hoop, W.J.; Spearman, M.L.: Factory Physics. New York, NY et al.: McGraw-Hill/ Irvine, 2011.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.1

5.1.2 Industrial Services

Course Name			
Industrial Services			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Fundamentals in Production and Operations Management	Prof. Dr. Hansjörg Fromm
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, demos and exercises	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56
Overall Course Objectives			

The course gives the students an understanding of the transformation that the industry is currently undergoing in becoming more service-oriented ("servitization"). The main trends and their economic implications will be highlighted. The importance of mathematical methods and IT will be demonstrated for "classical" service areas like spare parts planning and call center operations, but also for evolving areas like predictive maintenance and full-service contracts.
Learning Targets
Participants ▪ get an deep insight into the trends in industrial services. ▪ gain competencies in the most important operational issues in industrial services and the mathematical methods used for decision support.
Course Content
The course addresses the following topics: ▪ What are Industrial Services? - Introduction and Overview ▪ From "Classical Maintenance" to "Servitization" ▪ Spare Parts Planning – Location and Inventory Planning ▪ Service Technician Planning ▪ Call Center Services ▪ Condition-Based Monitoring, Predictive Maintenance ▪ Service Business Models – Full Service Contracts ▪ IT-Enabled Value-Add Services
Literature
For an introduction: ▪ Oliva, Kallenberg: Managing the transition from products to services (2003) ▪ Cohen, Agrawal, Agrawal: Winning in the Aftermarket (2006) ▪ Neely, The Shift to Services: Trends, Challenges and Opportunities (2012)
Prerequisites for participation in course
Basics in calculus, statistics and probability theory.
Modality of Exam
See 5.1

5.1.3 Operations Research: Decision Making with Linear Models and Networks

Course Name			
Operations Research: Decision Making with Linear Models and Networks			
Semester	Module Type	Allocated to the following Module	Lecturer

1	Compulsory (course is assigned to student by examination board)	Fundamentals in Production and Operations Management	Prof. Dr. Oliver Stein
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, exercises and case studies	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56

Overall Course Objectives

Understanding of decision making and optimization models and algorithms, in particular, in linear and network optimization.

Learning Targets

Participants

- name and describe the basic terms of crucial subareas in the subject Operations Research (Linear Optimization, graphs and networks)
- know the vital methods and the related mathematical models for a quantitative analysis
- gain knowledge of modeling and classification of optimization problems such as the selection of suitable solution procedures in order to solve optimization problems independently.
- validate, illustrate and interpret received solutions.

Course Content

The course covers the following topics:

- Introduction: Basic concepts of decision making, optimization models, algorithms, and applications, time complexity of algorithms.
- Linear Programming (LP): Modeling linear programs, simplex method, duality, transportation, transshipment, and assignment problems, elements of game theory.
- Network optimization: Graphs and networks, shortest paths in networks, maximal and minimum cost flows in networks, minimal spanning trees.

Literature

- F.S. Hillier, G.J. Lieberman: Introduction to Operations Research, McGraw-Hill, 2005
- K. Neumann, M. Morlock: Operatiosn Research, Hanser, 2002.
- H. Büning, P. Naeve, G. Trenkler, K.H. Waldmann: Mathematik für Ökonomen im Hauptstudium, Oldenburg, 2000

Prerequisites for participation in course

Calculus and linear algebra, use of basic software (e.g., Excel).

Modality of Exam

See 5.1

5.1.4 Information Systems: Fundamentals of Computer Science for Engineers

Course Name			
Information Systems: Fundamentals of Computer Science for Engineers			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Fundamentals in Production and Operations Management	Prof. Dr.-Ing. Jivka Ovtcharova
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, exercises and project work	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44

Overall Course Objectives

- Product-related information management in and between enterprises.
- View of the entire planning, control and organization as well as other necessary processes.
- Creation and holistic administration of all data, documents and resources within the entire Product Life Cycle.

Information Systems I is a basic course, required for the students planning to attend Information Systems II.

Learning Targets

Participants

- gain insight into the planning, controlling and organization of information flows.
- gain knowledge of the maintenance of all data, documents and processes within the product life cycle.
- are capable of understanding the implementation of the product life cycle.
- gain knowledge of data modeling, product data management, ERP Systems.

Course Content

This course is divided into three main parts. The first part is devoted to the Fundamentals of Information and Data Modeling. The second part describes the Product Life Cycle (PLC) in terms of information types and different PDM, ERP, CRM, SCM systems within this approach. The functional overview of PLM (PLC Management) Systems as well as Model Driven Architectures are the main aspects in this part. The third part focuses on detailed description of IT Architecture, Communication Mechanisms and Commercial PLM Solutions.

Literature

Gray, Peter M. D.: The functional approach to data management : modeling, analyzing and integrating heterogeneous data / Peter M. D. Gray - Berlin ; Heidelberg : Springer, 2003

Prerequisites for participation in course

The prerequisites for this course are the basics of computer science and general understanding of Information Technologies. Skills and knowledge in Business Processes and Product Life Cycle are also beneficial for students.

Modality of Exam

See 5.1

5.2 IT Support of Production Systems

Module Name			
IT Support of Production Systems			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Engineering	Prof. Dr.-Ing. Jivka Ovtcharova	6
Module Content			
IT support of production systems is an essential part in state of the art production systems. E.g., virtual engineering is the early, continuous, integrated support of the development process as regards to the adjustment, evaluation, and concreteness of the development results from all partners with the help of virtual prototypes. Modern production systems strongly depend on an appropriate IT support during the complete lifecycle. For this reason, this module focuses on understanding, generating, and analyzing models from various domains. On this basis, evaluation and optimization methods are applied to new problems and extended. Methodological competences are combined with scientific work in the areas of product lifecycle management, simulation, and optimization.			
Learning Results (LR)			
LR-1: Description of application scenarios for modern CAD systems and modeling methods, other CAx systems, and of virtual development systems for optimization and decision-making, identification of their limits, and extension of their potentials. LR-2: Knowledge of physical material flow and monetary controlling, derivation of efficient characteristics (KPI and KPR). LR-3: Integration of the aspects of man, machine, and material in simulation models, understanding of the limits of various types of modeling, and generation and adaptation of appropriate models in the domains. LR-4: Use of modern and heuristic algorithms for practical problem solution in the field of integer, nonlinear, and dynamic programming.			
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 EM 2 (5.2)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.2.1 Information Systems: Product Lifecycle Management	Oral examination	Oral group examination, approx. 15 minutes per candidate	None	At the end of the course week	yes
5.2.2 Stochastic Models of	Oral examination	Oral group examination, approx. 15 minutes per candidate	None	At the end of the course week	yes

Manufacturing Systems					
5.2.3 Simulation of Production Systems	Examination of another kind	Presentation of Case Study, approx. 15 minutes per candidate	None	During course	yes
5.2.4 Operations Research: Decision Making with Discrete and Nonlinear Models	Oral examination	Approx. 20 minutes per candidate	None	At the end of the course week	yes
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.2.1 Information Systems: Product Lifecycle Management

Course Name			
Information Systems: Product Lifecycle Management			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	IT Support of Production Systems	Prof. Dr.-Ing. Jivka Ovtcharova
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, exercises and project work	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56

Overall Course Objectives

- Rapid development cycle as an active process element.
- Emphasis on early development phases.
- Formulation of alternative concepts for the product.
- Decision and specification of product

Information Systems: Product Lifecycle Management is an intermediate course following and completing the course Information Systems: Fundamentals of Computer Science for Engineers.

Learning Targets

Participants

- gain knowledge of CAx and VR Systems.
- acquire fundamentals of data interfaces.

Course Content

This course is divided into three main parts. The first part is an introduction to modern CAD systems and modeling methods. The second part describes the CAx systems including the CAD, CAPP, CAE, etc. The third one is devoted to virtual engineering, based on the definition of a process, methodology and technology such as VR, AR and MR.
Literature
▪ Roller, Dieter: CAD systems development tools and methods - Berlin ; Heidelberg : Springer, 1997 ▪ Kalawsky, Roy S.: The science of virtual reality and virtual environments : a technical, scientific and engineering reference on virtual environments - Wokingham, England : Addison-Wesley, 1993
Prerequisites for participation in course
The prerequisites for this course are basics of computer science and general understanding of information technologies. Skills and knowledge in CAx systems and virtual engineering are helpful. Participants are required to attend the course *Information Systems: Fundamentals of Computer Science for Engineers* and to pass successfully the oral exam after its completion.
Modality of Exam
See 5.2

5.2.2 Stochastic Models of Manufacturing Systems

Course Name			
Stochastic Models of Manufacturing Systems			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	IT Support of Production Systems	Prof. Dr.-Ing. Kai Furmans
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, exercises, laboratory work	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44
Overall Course Objectives			
▪ Understanding the importance of stochastic processes in Production and Operations Management. ▪ Learning methods that enable the participant to manage stochastic behavior of networked systems. The course provides an insight into factory physics, which is helpful for understanding Supply Network Management I-III, Production Engineering, Simulation of Production Systems and Quality Management.			
Learning Targets			
Participants ▪ gain competencies of the calculation of operating figures of stochastic networks ▪ analyze the interdependency in product life cycles with methodic models			

▪ are able to apply methodic models to questions of Lean Management
Course Content
This course introduces the basics of stochastic models of manufacturing systems with an emphasis on queuing theory. After presenting examples for different kinds of single-stage systems and the approach for describing them analytically, the students are familiarized with effects occurring in queuing networks. Finally the skills acquired in this course are applied to several of the methods of lean manufacturing to understand the mechanisms and provide the participants an insight into their specific industry environment.
Literature
▪ S.C. Graves, A.H.G. Rinnooy Kan, P.H. Zipkin: Logistics of Production and Inventory, North Holland, 1993. ▪ Kai Furmans: Bedientheoretische Methoden als Hilfsmittel der Materialflußplanung, Wissenschaftliche Berichte des Instituts für Fördertechnik und Logistiksysteme der Universität Karlsruhe (TH); Bd. 52, 2001.
Prerequisites for participation in course
Crash Course *in Probability and Statistics* is required. Basics in Stochastics, Linear Algebra
Modality of Exam
See 5.2

5.2.3 Simulation of Production Systems

Course Name			
Simulation of Production Systems			
Semester	Module Type	Allocated to the following Module	Lecturers
1	Compulsory (course is assigned to student by examination board)	IT Support of Production Systems	Prof. Dr.-Ing. Kai Furmans Dr. Sven Spieckermann
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures, exercises and laboratory work	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44
Overall Course Objectives			
▪ Learning concepts of simulation and understanding different approaches used in modeling tools. ▪ Understanding the benefits of dynamical analyses of processes. There are interrelations with the lectures in Supply Network Management and Distribution Networks.			
Learning Targets			

Participants ▪ gain competencies of the general simulation comprehension. ▪ learn to analyze practical problems and to develop approaches to solving a problem with simulation models. ▪ synthesize the gained knowledge with the goal to be able to pick appropriate simulation instruments, to use these in product systems and to apply and implement the results respectively. ▪ compare the gained knowledge with the respective personal working experiences of the participants of discussion groups.
Course Content
This course gives the students an insight into the analysis of production and supply networks by simulation. The topics covered in this course include: Random numbers; discrete simulation; waiting queue models and statistical analysis; simulation packages; material flow-oriented simulation; simulation of warehouses and distribution systems; machine simulation; robotics simulation; shop floor simulation; simulation of semi-automated assembly systems; personnel-oriented simulation; enterprise simulation.
Literature
Averill Law; David Kelton: Simulation Modelling and Analysis, New York: McGraw-Hill, 2000.
Prerequisites for participation in course
▪ Basic knowledge of production systems ▪ Basic knowledge of production management ▪ Basic knowledge of manufacturing processes
Modality of Exam
See 5.2

5.2.4 Operations Research: Decision Making with Discrete and Nonlinear Models

Course Name			
Operations Research: Decision Making with Discrete and Nonlinear Models			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	IT Support of Production Systems	Prof. Dr. Oliver Stein
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56
Overall Course Objectives			

Understanding of integer and nonlinear optimization in contrast to pure linear programs for modeling of practical problems and corresponding solution techniques.

Learning Targets

Participants

- learn and apply the basic terms of the key sections of the subject Operations Research (integral and combinatorial optimization, non-linear optimization, dynamic optimization and stochastic models),
- mold and classify optimization problems and chose suitable solution processes in order to solve optimization problems independently,
- are able to apply known optimization processes and possibilities to develop new procedures.

Course Content

This course covers the following topics:

- Integer programming: Integer programs and LP relaxations, branch-and-bound and branch-and-cut methods, heuristic algorithms, important combinatorial optimization problems from practice.
- Nonlinear programming (NLP): Differences between LP and NLP models, optimality conditions in NLP, most useful NLP algorithms.
- Dynamic programming (DP): Sequential decision processes, Bellman's optimality principle and functional equation, solution of DP problems.
- Inventory control and lot sizing: Components of inventory or lot sizing models, deterministic models with continuous and periodic review, stochastic models.

Literature

- Hillier & Lieberman, Introduction to Operations Research, Holden-Day, 2009
- Murty, Operations Research, Prentice Hall, 2005.
- Winston, Operations Research - Applications and Algorithms, PWS-Kent, 2003

Prerequisites for participation in course

Calculus and linear algebra, use of basic software (e.g. Excel). Participants are required to attend the course *Operations Research: Decision Making with Linear Models and Networks* and to pass successfully the oral exam after its completion.

Modality of Exam

See 5.2

5.3 Methods of Operations Management

Module Name			
Methods of Operations Management			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Engineering	Prof. Dr.-Ing. Gisela Lanza	6

Module Content

The ever-growing integration and globalization of production structures lead to an increasing importance of operations management for cost and performance development in operations networks. Consequently, the module “Methods of Operations Management” focuses on the further development of the corresponding skills and competences in this field. Participants are to enhance their knowledge in order to be able to understand production and supply chain management taking into account human resources. At the same time, mapping of the physical world onto the world of planning and controlling has to be understood. On this basis, this module concentrates on applying the lessons learned as well as on the further development of the methodology and its integration in the teamwork at the production company.

Learning Results (LR)

LR-1: Development of a holistic understanding of supply network management for decision-making and planning of the individual processes in the short, medium, and long terms.

LR-2: Modeling of production systems in a supply chain, identification of appropriate optimization methods, and problem solution with the help of appropriate tools.

LR-3: Understanding of the significance of the human factor in production management and learning of approaches and methods for ergonomic workplace design and work organization, evaluation and improvement of existing workplaces.

LR-4: Knowledge of methods to model stochastic impacts on supply networks and, on this basis, development of solutions and demonstration of their effectiveness.

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 EM 3 (5.3)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.3.1 Production Engineering	Oral examination	Oral group examination, approx. 15 minutes per candidate	Continuous attendance and strong participation	At the end of the course week	Yes
5.3.2 Strategic Supply Network Management	Oral examination	Oral group examination, approx. 15 minutes per candidate	None	At the end of the course week	Yes
5.3.3 Human Factors and Ergonomics	Examination of another kind	Term paper and take home exam	Continuous attendance and	Submission of paper at the end	Yes

			group work on a case study	of the course week	
5.3.4 Technologies of Distribution Networks	Oral examination	Oral group examination, approx. 15 minutes per candidate	none	At the end of the course week	Yes
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.3.1 Production Engineering

Course Name			
Production Engineering			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Methods of Operations Management	Prof. Dr.-Ing. Gisela Lanza
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	E-Learning Module, Lecture, Group Work	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56

Overall Course Objectives

- Overview of planning and designing production systems within the current climate of changing markets.
- Learn the different principles of lean production planning.
- Being able to understand and implement essential methods of production planning.

Learning Targets

Participants

- gain competencies for the planning of production systems.
- are able to analyze the performance requirements when planning production systems.
- are able to evaluate various solution methods for the design of production systems.
- are able to apply essential methods of production planning.

Course Content

This course focuses on both planning and operation of production systems considering business objectives as well as the value added chain. It introduces various planning methods and tools. Moreover, selected methods are being discussed and applied to real assembly lines. The course shows interconnections between the planning activities and the operating conditions and offers support for decision marking at all planning stages.

Literature
▪ Hopp, W. J.; Spearman, M. L.: “Factory Physics”, Waveland Pr Inc, 2011. ▪ Nahmias, S.: “Production and Operations Analysis”, McGraw-Hill/Irwin, 2008.
Prerequisites for participation in course
Special skills: Knowledge and experience with production systems are beneficial but not required. Knowledge about manufacturing and assembly processes is desirable but not necessary.
Modality of Exam
See 5.3

5.3.2 Strategic Supply Network Management

Course Name			
Strategic Supply Network Management			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Methods of Operations Management	Prof. Dr. Stefan Nickel
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44
Overall Course Objectives			
Understanding of the individual modules of an APS for supply network management and of the material and information flows between the modules.			
Learning Targets			
Participants ▪ gain knowledge of the basic decision and optimization problems in the Supply Chain. ▪ understand modules and optimization methods in the planning of a deterministic supply chain. ▪ are able to create modules independently and to apply them on questions in the branch of production and branch of logistics.			
Course Content			
The course covers the following topics:			

▪ Decision/ optimization problems and solution approaches for the following modules of an Advanced Planning System (APS): Demand planning, supply network design, master planning, BOM explosion and lot sizing, detailed production planning, procurement planning, distribution planning, short-term transportation planning, ATP. ▪ Specification of the APS modules for the examples "consumer goods manufacturing" and "computer assembly" discussed in course Supply Network Management I.
Literature
▪ De Kok & Graves, Supply Chain Management: Design, Coordination and Operation, Elsevier, 2003. ▪ Nahmias: Production and Operations Analysis, McGraw-Hill, 2008. ▪ Stadtler & Kilger, Supply Chain Management and Advanced Planning, Springer, 2005.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.3

5.3.3 Human Factors and Ergonomics

Course Name			
Human Factors and Ergonomics			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Methods of Operations Management	Prof. Dr.-Ing. Verena Nitsch
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and case studies	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44
Overall Course Objectives			
This course is designed to provide students an understanding of human aspects in Production Management. It is itself a prerequisite for the "Industrial Management Case Study".			
Learning Targets			
Participants ▪ have a basic understanding of human perception and cognition processes. ▪ are aware of the effects of the workplace on the individual and common sources of human error.			

▪ are equipped with the knowledge to apply human factors and ergonomics methods to design user-friendly products and ergonomic workplaces. ▪ are aware of current HFE standards.
Course Content
The course gives an introductory overview of the following topics: ▪ An Introduction to Human Sensory Perception and Information Processing ▪ Equipment, Workplace and Environmental Design ▪ Stress and Strain ▪ Anthropometry and Basic Biomechanics ▪ Human Error and Error Prevention ▪ Usability Engineering and User-centered Product Design ▪ Occupational Health and Safety ▪ Human Factors in Organizational Design and Management ▪ Human Factors and Ergonomic Methods and Standards
Literature
▪ Salvendy, G. (Ed.) (2006), Handbook of Human Factors and Ergonomics (3rd ed.), New Jersey: Wiley & Sons. ▪ Wickens, C.D., Lee, J.D., Liu, Y., Gordon Becker, S. E. (2004) An Introduction to Human Factors Engineering (2nd ed.) London: Pearson Prentice Hall.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.3

5.3.4 Technologies of Distribution Networks

Course Name			
Technologies of Distribution Networks			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Methods of Operations Management	Prof. Dr.-Ing. Kai Furmans
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and laboratory work	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56
Overall Course Objectives			

- Understanding the fundamentals of warehousing
- Understanding the fundamentals of distribution networks.

This course is related to Stochastic Models of Manufacturing Systems and Supply Network Management III

Learning Targets

Participants

- have basic knowledge of the structure and the design of distribution networks and their components.
- understand the relevant processes of material flow planning and is able to apply these.
- independently evaluate various logistics processes.
- are able to reasonably apply planning processes.

Course Content

This course provides the students with fundamental knowledge in warehousing and distribution networks. Starting with an overview of the functional areas of distribution centers, the course will cover warehouse technology and dimensioning, cycle times, order picking and the control of a distribution center in more detail. Subsequently the students are introduced to the strategic perspective of distribution – from applicable distribution strategies, such as direct delivery or cross docking, to planning distribution networks.

Literature

- John J. Bartholdi III, Steven T. Hackman: Warehouse Science, 2005 (www.warehouse-science.com)
- Edward Frazelle: World-class warehousing and material handling, MacGraw-Hill 2002.

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.3

5.4 Networks of Supply and Production Systems

Module Name			
Networks of Supply and Production Systems			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Engineering	Prof. Dr.-Ing. Kai Furmans	6

Module Content

Today's competitive environment regarding supply chains has dramatically changed. Emerging economies such as China have become key players and have changed the view on modern network systems. Supply Chain Management plays a key role in "Production and Operations Management". Having understood the individual objects in the added value chain, these have to be combined in the supply chain. This includes the internationalization of processes of values added, their distribution to physical and dispositive processes as well as methods for their planning and control.

For this purpose, new models have to be generated and existing models have to be further developed and adapted. Multidisciplinary analysis of the production logistics point of view and its mathematical modeling are of particular significance. In this way, the participants can derive profound statements relating to the performance of novel network structures.

Learning Results (LR)

LR-1: Familiarization with technical interactions and challenges of modern logistics systems, use, solution, and implementation of models covering major issues.

LR-2: Independent mathematical modeling of decision/ optimization problems and formulation and compilation of solutions for various modules of the APS (advanced planning system).

LR-3: Knowledge of methods to control logistics systems with the help of IT systems, organization of such systems, and adaptation to the tasks to be solved.

LR-4: Understanding of the relevance, opportunities, and motivation of the internationalization of producing companies and of the solutions to cope with the resulting challenges and risks.

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 EM 4 (5.4)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.4.1 Supply Network Management: Inventory Management in an Uncertain Environment	Oral examination	Oral group examination, approx. 15 minutes per candidate	None	At the end of the course week	Yes
5.4.2 Information Technology for Logistic Systems	Written examination	60 minutes	None	Right after the course	Yes

5.4.3 Global Production	Oral examination	Oral group examination, approx. 15 minutes per candidate	Continuous attendance and strong participation	At the end of the course week	Yes
5.4.4 Operational and Tactical Supply Network Management	Oral examination	Oral group examination, approx. 15 minutes per candidate	None	At the end of the course week	Yes
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.4.1 Supply Network Management: Inventory Management in an Uncertain Environment

Course Name			
Supply Network Management: Inventory Management in an Uncertain Environment			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Networks of Supply and Production Systems	Prof. Dr.-Ing. Kai Furmans
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and laboratory work	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56

Overall Course Objectives

The course teaches students the following:

- Knowledge on the basics of material flow systems.
- Understanding and modeling of logistic processes

This course is strongly related to the courses named in „Prerequisites“. Moreover there are connections to distributions networks and production systems.

Learning Targets

Participants

- gain the competency to model logistic processes.
- understand the effects of stochastic processes on the supply chain.
- are able to analyze the causes of unwanted behavior in the supply chain.
- are able to apply appropriate counteractions in a case study.

Course Content

In Supply Network Management: Inventory Management in an Uncertain Environment, the fundamentals of material flow systems and logistic processes are introduced to the students. Starting with basic elements of material flow systems and their

transformation into models, the students learn how to plan material flow systems. Further contents are stock management and order picking, different approaches for modeling logistic processes, the bullwhip-effect, stochastic effects in logistics systems and line balancing in the automotive industry.
Literature
H. Stadtler, C. Kilger (editors): Supply Chain Management and Advanced Planning, Springer 2004.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.4

5.4.2 Information Technology for Logistic Systems

Course Name			
Information Technology for Logistic Systems			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Networks of Supply and Production Systems	Mathias Thomas
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and field trip	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56
Overall Course Objectives			
See content			
Learning Targets			
Participants gain knowledge of information systems in order to support logistic processes and are able to choose and utilize them according to the requirements of the Supply Chain.			
Course Content			
This course covers the following topics: ▪ Communication systems ▪ Material flow / warehouse management ▪ Master control station ▪ Expert knowledge / practical field reports ▪ New Software: Endurance test for your business?			

Literature
None
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.4

5.4.3 Global Production

Course Name			
Global Production			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Networks of Supply and Production Systems	Prof. Dr.-Ing. Gisela Lanza
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and case studies	Total 43,2h, hereof 18h contact hours, 25,2h homework and self-studies	1,44

Overall Course Objectives
The course provides a comprehensive coverage of modern management knowledge concerning international production. The objective is to give young professionals a sound understanding of the types and motivations for international production. Focus is the aim to show challenges and risks of international production and to support young professionals working in an international environment.
Learning Targets
Participants ▪ gain knowledge of various management approaches in international production ▪ are able to recognize requirements and risks in international production based on this knowledge and can design risk strategies for the internationalization of production
Course Content
This course gives an overview of the approaches and principles in international production. It starts by introducing the principles of international production and types of international activities. The course continues with sales-motivated internationalization and cost-oriented internationalization. It concludes with latest developments in challenges and risks of international activities and international project management.
Literature

John, R. et al: Global Business Strategy: An Introduction International Thomson Business Press, 1996, ISBN 1861523521
Prerequisites for participation in course
Basic knowledge in production systems is required.
Modality of Exam
See 5.4

5.4.4 Operational and Tactical Supply Network Management

Course Name			
Operational and Tactical Supply Network Management			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Elective	Networks of Supply and Production Systems	Prof. Dr. Stefan Nickel
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 43,2, hereof 18h contact hours, 25,2h homework and self-studies	1,44

Overall Course Objectives

Understanding of the basic decision-making processes that arise in supply network management and are derived from managerial and economic considerations.

Learning Targets

Participants

- understand the structure and interaction of the elements of a supply chain.
- gain knowledge of supply network processes including purchase, production, distribution and sale within long-, medium- and short-term planning.
- are able to analyze the connections of impact and to rate the optimization processes.

Course Content

This course covers topics in supply network management including supply network attributes, examples of supply networks (consumer goods manufacturing and computer assembly), strategic decision making in supply networks, supply network planning and tasks and requirements, hierarchical planning, architecture of an Advanced Planning System for supply network management.

Literature

- De Kok & Graves, Supply Chain Management: Design, Coordination and Operation, Elsevier, 2003
- Nahmias: Production and Operations Analysis, McGraw-Hill, 2008.
- Stadtler & Kilger, Supply Chain Management and Advanced Planning, Springer, 2005.

Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.4

5.5 Global Production and Distribution Systems

Module Name			
Global Production and Distribution Systems			
Semester	Subject	Module Supervisor	Credit Points for Module
3	Engineering	Prof. Dr.-Ing. Gisela Lanza	6

Module Content

The module "Global Production and Distribution Systems" takes place in China. The lectures "Quality Management" and "Supplier Management" take place at the KIT branch in Suzhou. The lecture "Smart Manufacturing and Automation with Industry 4.0" takes place at the AMTC and the Tongji University in Shanghai.

Made in China is becoming more and more important for global acting companies. In 1990, China produced less than 3% of global manufacturing output by value; nowadays its share is nearly a quarter. The white heat of China's ascent formed supply chains which reach deep into South-East Asia.

Global players therefore continually extend their production sites in China. At the same time, the demand for engineers with highly developed technological know-how and the ability to meet the different on-site requirements is rapidly growing.

Due to this the final engineering module takes place in Suzhou/ China (close to Shanghai) in cooperation with GAMI in AMTC. It is composed of compact knowledge transfer in lectures, case studies as well as excursions and company tours. The latter will provide participants with profound insights into the practical implementations in a Chinese production environment. The module does not only provide state-of-the-art knowledge transfer on-site, but also allows useful exchange with professionals and executives working in China.

Learning Results (LR)

LR-1: Combination of practical and theoretical quality management knowledge along the chain of values added in industry.

LR-2: Participants will be able to recognize, understand and apply methodologies to manage suppliers globally.

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 EM 5 (5.5)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.5.1 Quality Management	Oral examination	Oral group examination, approx. 30 minutes per candidate	Continuous attendance and strong participation	Right after the course	Yes
5.5.2 Supplier Management					
5.5.3 Smart Manufacturing and Automation with Industry 4.0	Oral examination	Approx. 15 minutes per candidate	None	During course	Yes

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

5.5.1 Quality Management

Course Name			
Quality Management			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Elective	Global Production and Distribution Systems	Prof. Dr.-Ing. Gisela Lanza
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and case studies	Total 46,8h, hereof 19,5h contact hours, 27,3h homework and self-studies	1,56
Overall Course Objectives			
The course provides a comprehensive coverage of modern quality management practice starting from basic principles and ending with state-of-the-art concepts and applications. The objective is to give young professionals a sound understanding of methods and tools and their practical application in a wide variety of both product and process situations.			
Learning Targets			
Participants ▪ understand the different quality principles. ▪ are able to apply the identified tools and methods of the Quality Management on new problems. ▪ are capable of analyzing and evaluating the applicability of the learned methods, processes and techniques for a certain problem.			
Course Content			
This practice-oriented course gives an overview of the approaches and methods in quality management (QM) starting from QM philosophies and preventive methods to operational quality assurance including industrial measurement technology and statistical process control.			
Literature			
Juran, J. M. / Defeo, J.: Juran's Quality Handbook, 6th edition, McGraw-Hill Professional, New York, 2010, ISBN 978-0-07-162973-7			
Prerequisites for participation in course			
Necessary knowledge for the course includes a basic understanding of manufacturing systems as well as statistics and probability theory. No special skills are required.			
Modality of Exam			
See 5.5			

5.5.2 Supplier Management

Course Name			
Supplier Management			
Semester	Module Type	Allocated to the following Module	Lecturers
3	Elective	Global Production and Distribution Systems	Prof. Dr.-Ing. Gisela Lanza Tobias Arndt
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures	Total 43,2h, hereof 18h contact hours, 25,1h homework and self-studies	1,44

Overall Course Objectives

The course provides a comprehensive overview of the strategic sourcing process and the corresponsive Supplier Relationship Management. The course is aiming to give young professionals detailed insights to strategical and operational Supplier Relationship Management tools and methodologies as well as their practical application.

Learning Targets

Participants

- understand the different Supplier Relationship Management tools.
- are able to apply the identified tools and methods of Supplier Relationship Management.
- are capable of analyzing

Course Content

This practice-oriented course gives an overview of the approaches and methods in Supplier Relationship Management starting from prerequisite of Supplier Relationship Management in China to strategical and operational Supplier Relationship Management methodologies.

Literature

Chopra, S.; Sodhi, M. S.: Managing Risk to avoid Supply-Chain Breakdown, MIT Sloan Management Review 2004

Lambert, D. M., & Schwieterman, M.A.: Supplier relationship management as a macro business process. Supply Chain Management: An International Journal, 17(3), 337–352., 2012

Lanza, G.; Ruhrmann, S.: Leitfaden zur Planung und Durchführung von Sourcingprojekten. in: FQS-DGQ-Schriftenreihe, Frankfurt am Main, Auflage 1, 2013

Large, R.: Strategisches Beschaffungsmanagement: Eine praxisorientierte Einführung mit Fallstudien. 3. vollständig überarbeitete und erweitere Auflage, Gabler, Wiesbaden, 2006.

Ruamsook, K.; Ruusel, D.; Thomchick, D.: U.S. Sourcing from Low-Cost Countries - A Comparative Analysis of Supplier Performance. In: The Journal of Supply Chain Management, 2007

Prerequisites for participation in course

Necessary knowledge for the course includes a basic understanding of manufacturing systems as well as Supply Chain Management. No special skills are required.

Modality of Exam
See 5.5

5.5.3 Smart Manufacturing and Automation with Industry 4.0

Course Name			
Smart Manufacturing and Automation with Industry 4.0			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Elective	Global Production and Distribution Systems	Prof. Dr.-Ing. Jürgen Fleischer
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lecture, Industrial Presentations, exercises	Total 90h, hereof 37,5h contact hours, 52,5h homework and self-studies	3

Overall Course Objectives

The trend towards industrial automation and Industry 4.0 will change production significantly in the future. Therefore, it is imperative to understand basic principles of automation and Industry 4.0 to meet the challenges facing production in the future. The course “Smart Manufacturing and Automation with Industry 4.0” addresses on one hand the current state of the art in smart automation and on the other hand provides an outlook on new technologies, businesses and opportunities arising out of digitalization, use of smart devices and in conclusion in Industry 4.0.

The concerted objective of the lecture is the basic knowledge for smart automation and Industry 4.0 within production.

Learning Targets

Participants

- are able to analyze implemented automated manufacturing systems and describe their components.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are able to design and select components for a given use case of the categories: "Handling Technology", "Industrial Robotics", "Sensory" and "Controls".
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

Course Content

- Introduction to Automated Production Systems
- Sensors, Controls and Drive Technology
- Handling Systems and Industrial Robots
- Automated Quality Control
- Manufacturing and Assembly Technology
- Multi Machine Systems
- Design and planning of automated production facilities
- Use Cases: Industry 4.0 in Industry

Literature
A comprehensive reader will be supplied.
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.5

6 Master Thesis Production and Operations 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 a faculty member from the HECTOR School.

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

Content	The Master Thesis should contain the following aspects: ▪ 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 9 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 worldwide 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 in 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 in production in Karlsruhe 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 in 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 lecture a written questionnaire is distributed among the participants by which they can evaluate the quality of the lectures. The main aspects 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 by the KIT and published on the Share Point of the HECTOR School and are discussed with lecturers and students.

8.3 Admissions Regulations

The official „Satzung für den Zugang zu dem weiterbildenden Masterstudiengang Production and Operations Management am Karlsruher Institut für Technologie" has been published here: http://www.sle.kit.edu/amtlicheBekanntmachungen2013.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 Production and Operations Management" has been published here: https://www.sle.kit.edu/downloads/AmtlicheBekanntmachungen/2017_AB_056.pdf

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

8.5 Fee Regulations

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

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