HECTOR SCHOOL
Technology Business School of the KIT

Karlsruher Institut für Technologie

Course Guide Book Intake 2020/2021

Executive Master Program
Financial Engineering

Contents

Contact & Imprint

HECTOR School of Engineering and Management, Karlsruhe Institute of Technology (KIT)

Schlossplatz 19, 76131 Karlsruhe/ Germany

Managing Director: Dr.-Ing. Judith Elsner

Phone: +49 (0) 721-608 47880, website: ***www.hectorschool.kit.edu***

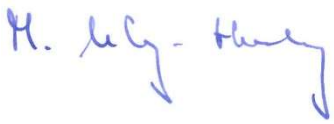
1 Foreword

Master the Financial Challenges: The Engineering Perspective makes the Difference

Assessing and controlling different types of risks are key responsibilities in the financial sector. The quality of risk management processes is a crucial factor in the success or failure of a business. Increasingly complex financial products, various regulations and the enormous importance of information technology have created a great challenge both to financial and non-financial companies. Mastering these challenges requires a thorough understanding of complex financial strategies, financial modeling ability, computational proficiency, and eventually, managerial vision.

In response to this demand, HECTOR School's Master Program in Financial Engineering offers a unique combination of familiarity to finance theory, engineering methods, management tools, mathematical and computational techniques. With its long tradition of interdisciplinary programs, the Karlsruhe Institute of Technology (KIT) provides an ideal interdisciplinary environment. Building on the long-established reputation for excellence in business engineering, the two-part program combines an in-depth knowledge and understanding of fundamental concepts in business, finance, and management on the one hand, with the latest developments in financial engineering on the other hand. With the pace of financial innovation, the need for highly qualified people trained in financial engineering also increases. A demanding career in a financial company such as an investment or commercial bank, an exchange or a rating agency would be an ideal place to work, with the abilities attained in the program. The techniques are also to the utmost benefit for candidates who pursue a career in a non-financial corporate, since the material covered is well applicable to corporate finance, and corporate risk management.

Meet us, to explore the Financial Engineering track at the Karlsruhe Institute of Technology (KIT). Join us, to acquire the tools that will guide your career path in this exciting area.



Prof. Dr. Marliese Uhrig-Homburg

Program Director of Financial Engineering

2 Program Directors

Title/ Name	Prof. Dr. Marliese Uhrig-Homburg	
Phone	+49 (0)721-608 48183	
E-Mail	***Marliese.Uhrig-Homburg@kit.edu***	
Affiliation	Institute for Finance, Banking and Insurance, KIT Endowed Chair (DZ Bank) of Financial Engineering and Derivates Postfach 6980, 76049 Karlsruhe	
Current Position	Director for Finance, Banking and Insurance, KIT	
Vita	1995 Ph.D. (Dr. rer. Pol.) Finance, Universität Mannheim 2001 Habilitation (venia legendi in Business Administration), Universität Mannheim Offers of professorships to the universities Greifswald, Ulm, Cologne and the European Business School 2002 Appointed full professor Karlsruhe Institute of Technology (KIT) 2005 – today Director for Finance, Banking and Insurance, KIT	
Fields of Interest	▪ Finance and Financial Engineering ▪ Derivative Securities ▪ Fixed income markets and term structure theory ▪ Empirical Finance ▪ Corporate Finance	
Memberships & Awards	▪ Advisory board of the German Finance Association ▪ European Finance Association (EFA) ▪ American Finance Association (AFA) ▪ European Financial Management Association (EFMA)	

Title/ Name	Prof. Dr. Martin E. Ruckes	
Phone	+49 (0)721-608 43427	
E-Mail	***Martin.Ruckes@kit.edu***	
Affiliation	Co-head of Institute of Finance, Banking, and Insurance, KIT	
Current Position	Co-head of Institute of Finance, Banking, and Insurance, KIT	
Vita	• Assistant Professor of Finance, Dept. of Finance, School of Business, University of Wisconsin Madison, 2000-2007 • Research Associate, Dept. of Economics, University of Mannheim, 1998-1999 • Research Fellow, Dept. of Economics, University of Mannheim, 1997-1998 • Lecturer, Dept. of Finance, School of Business, University of Wisconsin-Madison, 1997 • Visiting Scholar, Dept. of Economics, Boston University, 1996 • Visiting Researcher, Dept. of Economics, Université Libre de Bruxelles, 1996 • Member of DFG Graduiertenkolleg “Allokation auf Finanz- und Gütermärkten”, University of Mannheim	
Fields of Interest	• Primary fields: Corporate Investment, Corporate Finance, Economics of Organizations, Banking • Secondary fields: Contract Theory, Industrial Organization	
Memberships & Awards	• Research grant (“On the Structure of the Modern Financial System”), BBBank, 2009 • Research grant (“Managerial Entrenchment and Corporate Investment”), Graduate School of the University of Wisconsin-Madison, 2006 • Research grant (“Coordination Risk in Lending and the Capital Structure of Arbitrageurs”), Graduate School of the University of Wisconsin-Madison, 2005 • Research grant (“Arbitraging Arbitrageurs”), Graduate School of the University of Wisconsin-Madison, 2003 • Research grant (for research visit at Boston University), German Academic Exchange Service, 1996-1997 • Scholarship (for participating in the Ph.D. program at the University of Mannheim), German Science Foundation, 1994-1996 • Research grant (for research visit at the Université Libre de Bruxelles), Erasmus Exchange Program, 1996	

3 Study Plan

3.1 Overall Program Objectives and Qualification Targets

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

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

3.2 Qualification Objectives for Financial Engineering

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

1. The graduates are able to thoroughly understand and analyze financial interconnections regarding their content, and optimize them. They are also able to develop innovative solutions based on fundamental economic laws, using instruments of mathematics and statistics.
2. They understand the design and further development of information markets and services. In addition, they are familiar with innovation processes and their implementation.
3. They can apply recognized financial theories, financial engineering methods, management tools, and mathematical and computational techniques and, at the same time, recognize the limits of models of economics and finance.
4. Their deep understanding of complex financial products and knowledge of capital markets enable them to meet the challenges of a globally active financial sector.
5. The graduates have an overview of the process of risk management and, using this background, are able to independently determine risks, assess them and derive recommendations for action.
6. They are further able to analyze and evaluate technological problems in the context of service management of financial products under economics aspects.
7. The graduates 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 acquired in-depth knowledge of stochastics and applied game theory and can apply these under the aspect of uncertainty.
10. 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.
11. They are able to understand marketing, and legal issue approaches in the corporate 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 Management	
				4. Legal Aspects of Information	
	Engineering	EM1	Digital Platforms	1. Enterprise Systems	8
				2. IoT Technologies & Platforms	
				3. Platform and Market Engineering	
	Engineering	EM2	Economics of Global Financial Markets	1. Financial Prototyping with Python	8
				2. Managing Equity Risk	
				3. Managing Fixed Income Risk	
	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	Massive Data Sets and Financial Machine Learning	1. Tools for Financial Engineering	8
				2. Data and Knowledge Engineering	
				3. Big Data Management	
	Engineering (elective)	EM4	Advanced Finance Theory	1. Corporate Financial Engineering	8
				2. Derivatives	
	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	Financial Machine Learning with AI	1. Financial Modelling with Python	8
				2. Financial Econometrics	
				3. Machine Learning for Risk and Asset Management	

Semester	Subject	Type of Module	Name of Module	Course	Credits
	Management	MM5	Strategy and People	1. Strategic Management	6
				2. Managerial Economics	
				3. Business Organization and Corporate Law	
				4. Strategic Human Resource Management	
				5. Leadership and Conflict Management	
		Thesis	Master Thesis (maximum 6 months)		20

Tab. 3-1 Study Plan FE

3.4 Academic Calendar Intake 2020

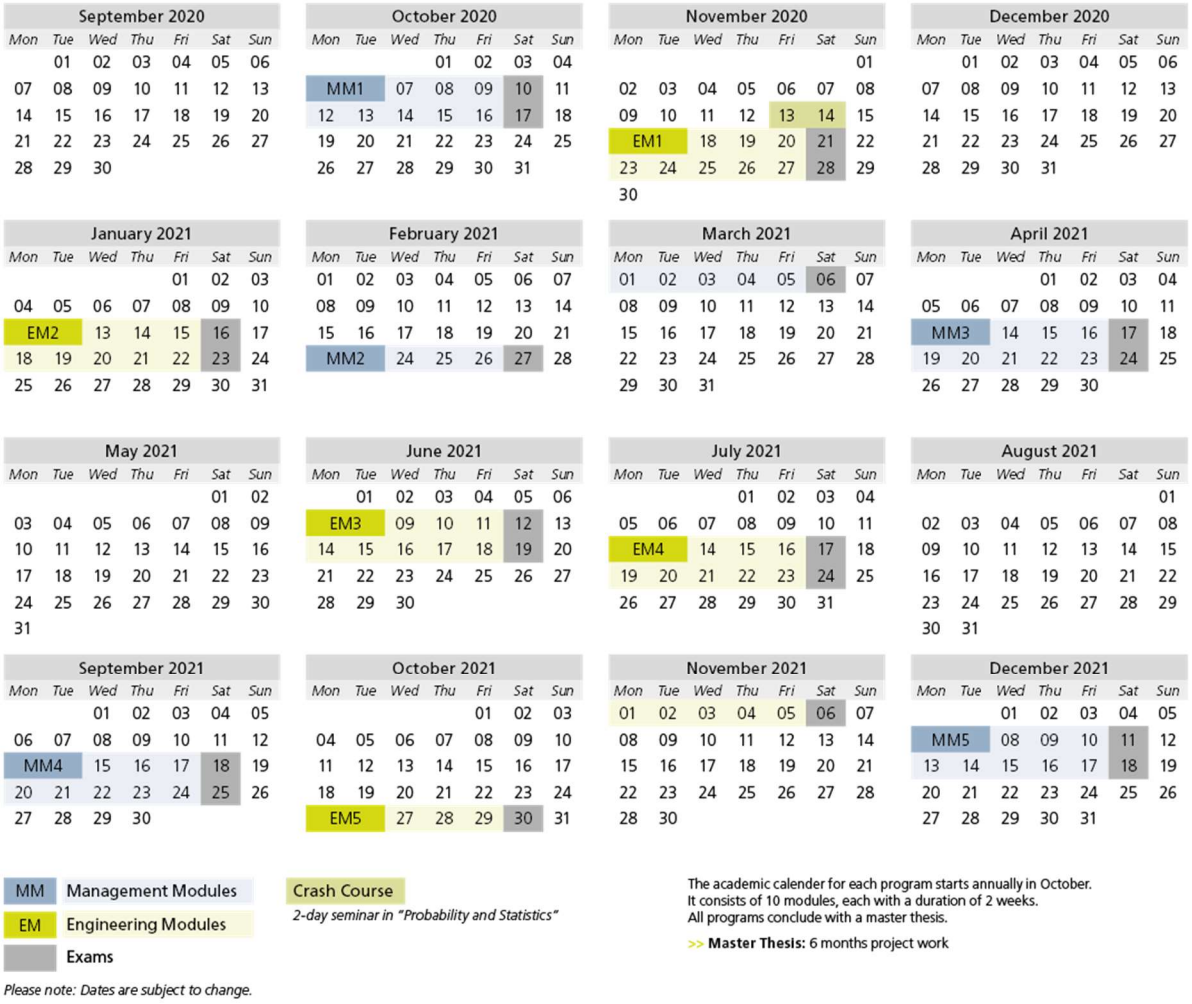


Figure 1: Academic Calendar Intake 2020

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 Financial Engineering 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 know-how. Therefore, all programs are based on 5 Management Modules where the participants are provided with general knowledge in Finance, Accounting, Marketing, Multi-Project Management and International Law so they can consider commercial consequences of business decisions.

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

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

3.6 Examination Structure

3.6.1 General Information

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

3.6.2 Examination Process

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

3.6.3 Exam Review

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

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

3.7 Lecturers

3.7.1 Management Modules

Name	Institute
Program Director	
Prof. Dr. Martin E. Ruckes	Institute for Finance, Banking and Insurance, KIT
Module Supervisors	
Prof. Dr. Martin Klarmann	Institute of Information Systems and Marketing, KIT
Prof. Dr. Stefan Nickel	Institute of Operations Research, KIT
Prof. Dr. Petra Nieken	Institute of Management, KIT
Prof. Dr. Martin E. Ruckes	Institute for Finance, Banking and Insurance, KIT
Prof. Dr. Orestis Terzidis	Institute for Entrepreneurship, Technology Management and Innovation
Lecturers in Alphabetical Order	
Dr. Abilio Avila	Institute for Entrepreneurship, Technology Management and Innovation
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 LLC
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, Heilbronn
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. Marliese Uhrig-Homburg	Institute for Finance, Banking and Insurance, KIT
Module Supervisors	
Prof. Dr. Alexander Mädche	Institute of Information Systems and Marketing (IISM), KIT
Prof. Dr. Martin E. Ruckes	Institute for Finance, Banking and Insurance, KIT
Prof. Dr. Marliese Uhrig-Homburg	Institute for Finance, Banking and Insurance, KIT
Prof. Dr. Maxim Ulrich	Chair of Financial Economics and Risk Management, KIT
Lecturers in Alphabetical Order	
PD Dr. Roland Bless	Institute of Telematics, KIT
Prof. Dr. York Sure-Vetter	Institute of Applied Informatics and Formal Description Methods (AIFB)
Prof. Dr. Christof Weinhardt	Institute of Information Systems and Management (IISM), KIT
Prof. Dr. Martina Zitterbart	Institute of Telematics, KIT

4 Description of the Management Modules

4.1 Marketing and Information

Module Name			
Marketing and Information			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Management	Prof. Dr. Martin Klarmann	6
Module Content			
Information becomes more and more important as a source of value creation for companies. This module looks at how information can be used to improve business performance in today's business environment. In the first week, the module looks at information-related topics in general, covering issues such as the implementation of information systems, the analysis of (big) data, and legal requirements surrounding the use of (customer) data in firms. In the second week, the module covers how to design and sell customer solutions. These hybrid offerings of products and services require careful analyses of customer information to work.			
Learning Results (LR)			
Participants will know: • How to set up effective information systems • Key issues surrounding the analysis of (big) data and machine learning • The boundaries to the use of information and data set by the legal environment • How to create value from information using customer solutions • 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 in "Designing and Selling Solutions". Approx. 15 minutes per candidate	None	During course	Yes
4.1.2 Information Systems Management	Examination of another kind	Presentation of Case Study in "Designing and Selling Solutions". 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

At the end of the course:

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

After successful completion of the module, participants

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

Workload

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

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

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

Control of Success

Module with several examinations:

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

The module contains the following study achievements:

- Case Study in course „Risk Aware Decisions“

Workload

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

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

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

4.3.1 Decision Modeling

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

Overall Course Objectives

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

Learning Targets

Participants

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

Course Content

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

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

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

Literature

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

Prerequisites for participation in course

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

Modality of Exam

See 4.3

4.3.2 Risk Aware Decisions

Course Name

Risk Aware Decisions (+Case Studies + Finance)

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

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

Overall Course Objectives

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

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

Learning Targets

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

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

Course Content

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

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

Literature

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

Prerequisites for participation in course

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

4.3.3 Interactive Decisions

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

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

Modality of Exam
See 4.3

4.3.4 Robust and Stochastic Optimization

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

Overall Course Objectives

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

Learning Targets

Participants

- learn to understand how uncertainty can effect decisions in optimization problems
- become able to decide when uncertainty should be modeled in optimization problems
- gain knowledge in modeling 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. 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 Digital Platforms

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

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

5.1.1 Enterprise Systems

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

Overall Course Objectives

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

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

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

Learning Targets

Participants:

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

Course Content

Currently in revision

Literature

Literature will be distributed with the course materials.

Prerequisites for participation in course

No prerequisites required.

Modality of Exam
See 5.1

5.1.2 IoT Technologies and Platforms

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

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

Modality of Exam
See 5.1

5.1.3 Platform and Market Engineering

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

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

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

5.2 Economics of Global Financial Markets

Module Name			
Economics of Global Financial Markets			
Semester	Subject	Module Supervisor	Credit Points for Module
1	Engineering	Prof. Dr. Maxim Ulrich	8

Module Content

The goal of this module is to develop an understanding of global capital markets. Open up any quality newspaper and you see that global financial markets matter a great deal. Nearly all employers are directly or indirectly affected by changing market prices. On the other hand, employees and households in general hold financial assets to save for retirement. It is therefore a natural question to understand how prices are formed on stock and bond markets and how to build optimal portfolios. It is the goal of this module to shed light on both questions. Last but not least, we teach students to solve financial problems with the powerful software program Python. Python is an easy to learn programming language that is ideally suited for fast prototyping as well as for high quality production code.

This module introduces theoretical, empirical and programming tools that are essential for understanding global financial markets. The main focus is twofold. First, based on case studies, students obtain valuable intuition that will turn out to be very useful for advanced courses and for the professional career. Second, students obtain a gentle introduction to financial prototyping with Python. Participants will understand the main risk / return characteristics of equity and fixed-income markets from a conceptual, empirical and computational point of view. There are scientific reasons for why in the long-run equity beats bond investments, and why it is even more advantageous to combine both asset classes into a single portfolio. Participants will understand the main risk / return characteristics of equity and fixed-income markets from a conceptual and empirical point of view and will start to feel comfortable writing financial software

Learning Results (LR)

LR-1: Knowledge of how to build optimal investment portfolios.

LR-2: Knowledge of which risks should be part of a portfolio and which should not.

LR-3: Gaining a solid understanding of what moves equity and fixed income markets.

LR-4: Be able to use Python for fast financial prototyping.

Workload

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

Controls of Success In EM 2 (5.2)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.2.1 Financial Prototyping with Python	Written examination	120 minutes	None	At the end of the module	Yes
5.2.2 Managing Equity Risk					

5.2.3 Managing Fixed Income Risk					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.2.1 Financial Prototyping with Python

Course Name			
Financial Prototyping with Python			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Global Financial Markets	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Problem based	Total 120h, hereof 37,5h contact hours, 82,5h homework and self-studies	4
Overall Course Objectives			
This course introduces students to Python. Python is a very powerful and easy to learn programming language that is used by both, statisticians and computer scientists. Students learn how to write functions, objects and routines in Python. The introduction is hands-on and relies on problems from the courses Managing Equity Risk and Managing Fixed-Income Risk.			
Learning Targets			
After successful completion of this course, students will know how to • program in Python • declare variables, functions and objects • read data from an Excel sheet or from a webpage • solve equity and fixed-income related risk and investment problems with python			
Course Content			
We cover the following topics: declaration of variables, reading-in data, transforming data, reading-out data; loops, functions, objects, optimization using local and global optimizer, plotting of results, loading data from the webpages.			
Literature			
Course reader will be provided.			
Prerequisites for participation in course			
No prerequisites required.			
Modality of Exam			
See 5.2			

5.2.2 Managing Equity Risk

Course Name			
Managing Equity Risk			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Global Financial Markets	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Case based, problem based	Total 62h, hereof 19,5h contact hours2 42,9h homework and self-studies	2,1
Overall Course Objectives			
The main objective of this is twofold. First, to make sense of global equity markets and second, to understand how to optimally build portfolios. The focus will be on providing valuable business-like intuition that will stay with students for the rest of their professional career and that is crucial for more advanced courses. Students will understand the main risk/return characteristics of equity markets from a conceptual and empirical point of view. There are scientific reasons for why in the long-run equity beats bond investments, and why it is even more advantageous to combine both asset classes into a single portfolio. It is the objective of this course to shed light on these scientific reasons.			
Learning Targets			
After successful completion of this course, students will: ▪ Know how to build optimal investment portfolios ▪ Know why some risks should be part of a portfolio, while others should be eliminated ▪ Be able to apply factor models to predict equity returns and risks			
Course Content			
We cover the following topics: risk and return, equity premium, portfolio management (Markowitz), predicting equity returns, CAPM, Fama and French 3-factor model, Efficient Market Hypothesis, diversification, no arbitrage, performance measurement.			
Literature			
A course reader will be provided			
Prerequisites for participation in course			
No prerequisites required.			
Modality of Exam			
See 5.2			

5.2.3 Managing Fixed Income Risk

Course Name			
Managing Fixed Income Risk			
Semester	Module Type	Allocated to the following Module	Lecturer
1	Compulsory (course is assigned to student by examination board)	Global Financial Markets	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Case based, project based	Total 58h, hereof 18h contact hours, 39,6h homework and self-studies	1,9

Overall Course Objectives

The main objective of this course is to make sense of global bond markets. Investing in the bond market is considered to be more technical than equity investing. Yet, we will continue with a hands-on case-based introduction into the technical bond pricing material. Students will understand the main risk/return characteristics of fixed-income markets from a conceptual and empirical point of view. Students learn how to manage the risk of a fixed-income portfolio and how fixed-income risk depends on the underlying macro economy.

Learning Targets

After successful completion of this course, students will:

- Know how to price fixed-income instruments
- Know how to extract meaningful investment information from the term structure of interest rates
- Know how to bootstrap different yield curves from bond prices
- Know how to use duration and convexity to manage interest rate risk
- Know how to predict short-term and long-term interest rates
- Know how the central bank affects different parts of the yield curve

Course Content

We cover the following topics: bond pricing, term structure of interest rates, interest rate risk, duration, relative value trades in fixed-income markets, inflation-indexed bonds, Taylor rule, Federal Reserve.

Literature

Course reader will be provided

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.2

5.3 Massive Data Sets and Financial Machine Learning

Module Name			
Massive Data Sets and Financial Machine Learning			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Engineering	Prof. Dr. Maxim Ulrich	8
Module Content			
Currently in revision			
Learning Results (LR)			
Currently in revision			
Workload			
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).			

Controls of Success In EM 3 (5.3)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.3.1 Tools for Financial Engineering	Written examination	60 minutes	None	At the end of the course	Yes
5.3.2 Data and Knowledge Management	Written examination	60 minutes	None	At the end of the course week	Yes
5.3.3. Big Data Management					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.3.1 Tools for Financial Engineering

Course Name			
Tools for Financial Engineering			
Semester	Module Type	Allocated to the following Module	Lecturer

2	Compulsory (course is assigned to student by examination board)	Valuation and Financial Analytics	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and case studies	Total 120h, hereof 37,5h contact hours 82,5h homework and self-studies	4

Overall Course Objectives
The course objective is three-fold. First, participants learn how to solve linear and separable ordinary and stochastic differential equations. Second, participants are trained to use such differential equations to forecast risk and returns of financial assets. Third, students apply empirical techniques such as linear and non-linear regression models to fit ordinary and stochastic differential equations to financial data.
Learning Targets
After successful completion of this course, participants will know how to: ▪ solve ordinary and stochastic differential equations with analytical methods ▪ set-up and estimate linear and non-linear regression models ▪ Fit the parameters of ordinary and stochastic differential equations to financial data
Course Content
We cover the following topics: ODE calculus, SDE calculus, linear and nonlinear regression model.
Literature
Provided in a separate course reader.
Prerequisites for participation in course
Successful completion of the course *Introduction to Global Financial Markets* (EM2).
Modality of Exam
See 5.3.

5.3.2 Data and Knowledge Management

Course Name			
Data and Knowledge Engineering			
Semester	Module Type	Allocated to the following Module	Lecturers
2	Compulsory (course is assigned to student by	Process and Knowledge Engineering	Prof. Dr. York Sure-Vetter

	examination board)		
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 72h, hereof 22,5h contact hours 49,5h homework and self-studies	2,4

Overall Course Objectives

To provide a framework of interdisciplinary knowledge, methods and skills to support understanding of Information and Knowledge Management with a focus on semantic web and web 2.0-technologies as well as semantic web services.

Learning Targets

Participants

- get to know and to apply methods and instruments in the area of “Information and Knowledge Management” and to demonstrate the capability to be innovative regarding the applied methods.
- learn the practical application of the use of semantic web-based systems.
- are capable of choosing and correctly applying the appropriate methods for the arising problems as part of the daily tasks.
- are put in the position to find and represent arguments for problem solving.

Course Content

The course primarily deals with recent technical advancements in Information and Knowledge Management with a focus on semantic web technologies and semantic web services. The course provides an overview of fundamental aspects and a general introduction to the topics. Practical tools and applications are jointly explored and give a hands-on experience to state-of-the-art semantic web- and web 2.0-technologies and how they can be used in corporate environments. In addition, semantic web services as a new paradigm for modeling, orchestrating and executing services are presented. Practical applications based on semantic web services are used to illustrate the potentials of the new technology.

Literature

- „Foundations of Semantic Technologies“; P. Hitzler, M. Krötzsch, S. Rudolph; CRC Press; 2009.
- Handbook of Ontologies“ by Staab/Studer (eds.) Springer Verlag 2009

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.3

5.3.3 Big Data Management

Course Name			
Big Data Management			
Semester	Module Type	Allocated to the following Module	Lecturers
2	Compulsory (course is assigned to student by examination board)	Process and Knowledge Engineering	Prof. Dr. York Sure-Vetter
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 48h, hereof 15h contact hours 33h homework and self-studies	1,6

Overall Course Objectives

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

Learning Targets

After completing the course, participants are able to:

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

Course Content

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

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

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

Literature

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

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

Prerequisites for participation in course

No prerequisites required.
Modality of Exam
See 5.3

5.4 Advanced Finance Theory

Module Name			
Advanced Finance Theory			
Semester	Subject	Module Supervisor	Credit Points for Module
2	Engineering	Prof. Dr. Marliese Uhrig-Homburg	8

Module Content
The module enables participants to understand the fundamentals and advances of modern financial economics, including corporate finance, derivatives and financial engineering. Knowledge of corporate finance concepts is essential for any corporate decision maker. On the other hand, understanding how to make optimal investment decisions and how to evaluate and to use derivatives for risk management is the backbone of most quantitative financial innovations. Students build advanced knowledge of economic theory, corporate finance, mergers and acquisitions, derivatives, and risk management. They develop quantitative and problem-solving skills in resolving complex financial decisions. Overall, it is the aim of this module to teach participants how to use financial concepts to make better decisions and to add value to institutions.
Learning Results (LR)
LR-1: Qualification to identify and evaluate cost-effective financing alternatives. LR-2: Qualification to assess corporate investment projects from a financial perspective. LR-3: Qualification to solve financial problems in the context of strategic interactions LR-4: Qualification to understand how to make well informed investment decisions LR-5: Qualification to understand the functioning of options and futures markets, arbitrage relations, and hedging principles. LR-6: Qualification to evaluate and manage derivative securities using option pricing theory.
Workload
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).

Controls of Success In EM 4 (5.4)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.4.1 Derivatives	Oral examination	15 minutes per participant	None	At the end of the course week	Yes
5.4.2 Fixed Income	Oral examination	15 minutes per participant	None	At the end of the course	Yes
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.4.1 Corporate Financial Engineering

Course Name			
Corporate Financial Engineering			
Semester	Module Type	Allocated to the following Module	Lecturer
2	Compulsory (course is assigned to student by examination board)	Valuation and Financial Analytics	Prof. Dr. Martin E. Ruckes
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures and exercises	Total 97,6h, hereof 30,5h contact hours 67,1h homework and self-studies	3,25

Overall Course Objectives

- Thorough knowledge of valuation models.
- Application of valuation models to corporate investments and mergers and acquisitions.
- Thorough knowledge of financial structure and payout policy models.
- Application of financial structure and payout policy models to complex investments and firms as a whole.

Learning Targets

Participants gain competencies for the analysis and evaluation of complex projects as well as the analysis and optimization of the pattern of finance of major projects and means of finance of businesses.

Course Content

Successful investment is critical to any firm. This course discusses how complex investment projects can be analyzed and evaluated. This includes the purchase of shares of another firm or the acquisition of an entire firm. Further, the course provides the methodological tools to analyze and optimize the financing structure and dividend policies of firms. All concepts are applied to real world situations.

Literature

- Titman, S. and J.D. Martin: Valuation, 3rd ed., Prentice Hall, 2010
- Berk, J. and P. DeMarzo, 3rd ed., Prentice Hall, 2010

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.3

5.4.2 Derivatives

Course Name			
Derivatives			
Semester	Module Type	Allocated to the following Module	Lecturers
2	Compulsory (course is assigned to student by examination board)	Advanced Financial Engineering	Prof. Dr. Marliese Uhrig-Homburg
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each summer semester	Lectures, exercises and cases	Total 142,4h, hereof 44,5h contact hours 97,9h homework and self-studies	4,75

Overall Course Objectives

The knowledge of how derivatives can be analyzed and priced is essential for any practitioner working in modern quantitative finance. The course also concentrates on tools for handling more complex and exotic derivatives. Furthermore, the management of risks present in financial markets can be crucial for both financial and non-financial institutions.

Learning Targets

Participants

- gain a comprehension of pricing in derivative markets.
- have competencies in the application of the option pricing theory for risk management purposes.

Course Content

Introduction to derivatives: Forwards, futures, options, exotic derivatives, no-arbitrage pricing, equilibrium pricing.

Forwards and futures: Valuation of forward contracts, forward and futures prices, marking to market, delivery options.

Options: Fundamental properties of option prices, binomial model, Black-Scholes model and extensions.

Financial engineering with derivatives: Greeks, delta hedging, risk management with derivatives.

Literature

- Hull, John C. (2017): Options, Futures and Other Derivatives; 10th Edition, Prentice-Hall
- Björk, T. (2009): Arbitrage Theory in Continuous Time, Third Edition, Oxford Finance.

Prerequisites for participation in course

- Successful participation in MM1 and in MM2
- Knowledge of modules EM 1-2 is strongly recommended

Modality of Exam

See 5.4

5.5 Financial Machine Learning with AI

Module Name			
Financial Machine Learning with AI			
Semester	Subject	Module Supervisor	Credit Points for Module
3	Engineering	Prof. Dr. Maxim Ulrich	8
Module Content			
The goal of this module is to teach students state-of-the-art computational tools for risk and asset management. This module teaches the concepts as well as the practical implementation of statistical tools that are necessary to estimate expected returns, risks and risk densities of different investment instruments. This course relies on risk and investment management problems to rigorously evaluate different methods.			
Learning Results (LR)			
LR-1: Modeling expected returns and risks using the ARMA-GARCH methodology. LR-2: Fit risk densities to financial and economic data, using methods such as maximum-likelihood, least-squares and Kalman filter. LR-2: Know how to program state-of-the-art estimation routines with Python.			
Workload			
Total 240h, hereof 75h contact hours, 165h homework and self-studies (hereof 65 during module, 100 in preparation of module).			

Controls of Success In EM 5 (5.5)	Modality of Examination	Performance and Duration of Examination	Prerequisites for Exam-participation	Examination Period	Graded
5.5.1 Financial Modelling with Python	Written examination	120 minutes	None	At the end of the module	Yes
5.5.2 Financial Econometrics					
5.5.3 Machine Learning for Risk and Asset Management					
Grading: The module grade shall be considered proportionally to the credits assigned to the courses.					

5.5.1 Financial Modelling with Python

Course Name			
Financial Modelling with Python			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Risk Management	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and cases	Total 120h, hereof 37,5h contact hours 82,5h homework and self-studies	4

Overall Course Objectives
This course teaches students how to model different types of risk densities with Python. Students write financial software to apply financial econometric and machine learning tools to forecast risks and returns of equity and fixed-income assets. Next to the software engineering focus, students also learn to implement the necessary numerical and optimization tools.
Learning Targets
After successful completion of this course, students will: • know how to write robust financial software with Python • know how to model and estimate all types of financial risks
Course Content
We cover the following topics: computational solution of optimization problems, Python implementation of estimation routines such as least-squares, maximum-likelihood, Kalman filter.
Literature
A course reader will be provided
Prerequisites for participation in course
No prerequisites required.
Modality of Exam
See 5.5

5.5.2 Financial Econometrics

Course Name			
Financial Econometrics			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Risk Management	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Problem based exercises	Total 62,4h, hereof 19,5h contact hours, 42,9h homework and self-studies	2,1
Overall Course Objectives			
This course teaches financial econometrics and applies it to risk and investment related problems. Students learn to apply econometric methods to estimate linear and nonlinear risk/return relationships and to model Gaussian and non-Gaussian risk densities.			
Learning Targets			
After successful completion of this course, participants will know how to: • apply the ARMA(p,q) set-up to predict expected returns • apply the GARCH(m,s) set-up to predict expected variances • apply maximum likelihood to estimate unknown parameters of the ARMA/GARCH models • evaluate the significance and performance of different forecasting models			
Course Content			
We cover the following topics: ARMA/GARCH modelling, least squares optimization, maximum likelihood			
Literature			
A course reader will be provided			
Prerequisites for participation in course			
No prerequisites required.			
Modality of Exam			
See 5.5			

5.5.3 Machine Learning for Risk and Asset Management

Course Name			
Machine Learning for Risk and Asset Management			
Semester	Module Type	Allocated to the following Module	Lecturer
3	Compulsory (course is assigned to student by examination board)	Risk Management	Prof. Dr. Maxim Ulrich
Recurrence	Mode of Teaching	Workload	Credit Points for Course
Each winter semester	Lectures and exercises	Total 57,6h, hereof 18h contact hours, 39,6h homework and self-studies	1,9

Overall Course Objectives

This courses teaches machine learning tools that are useful to estimate non-Gaussian risk densities in fixed-income and equity markets. We specialize to Bayesian machine learning tools and focus explicitly on Kalman filtering techniques to estimate unobserved return characteristics, such as time-varying volatility, time-varying expected returns and time-varying correlations.

Learning Targets

After successful completion of this course, participants will know how:

- to model linear, nonlinear and Gaussian, non-Gaussian risk densities within a state-space modeling framework
- the Kalman filter is able to make unobserved returns characteristics observable

Course Content

We cover the following topics: state-space modelling, linear Kalman filter, non-linear Kalman filter, estimating nonlinear factor models.

Literature

A course reader will be provided

Prerequisites for participation in course

No prerequisites required.

Modality of Exam

See 5.5

6 Master Thesis Financial Engineering

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

Tab. 6-1 Master Thesis scope and process

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

7 Karlsruhe Institute of Technology (KIT)

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

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

7.1 Department of Mechanical Engineering

Production Technology: Taking an integrated approach

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

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

Product Development and Design: The creative element

Product Development and Design have the goal of examining and developing a theoretical basis for methodical development processes including the respective computing systems (CAD/CAM). Taking traditional design methods as a starting point, researchers use an integrated approach to accompany and systematically manage the entire product development and production process. Complex product development and production tasks are solved in close cooperation with industry. In doing so the focus is on the entire development chain – from environmentally compatible and strategic product planning brainstorming all the way to creating complete three dimensional CAD designs is focused on. Simulations and prototype construction are also part of the process. Other research areas include:

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

7.2 Department of Economics and Business Engineering

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

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

Interdisciplinary research

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

The main fields of research include:

- Finance and capital market research
- Marketing and market research
- Mapping work processes using computer science
- Information management
- Production and materials flow management
- Ergonomics
- Sustainable construction
- Traffic prediction and transport network planning
- System dynamics and innovation
- Optimization, resource management and risk management
- Actuarial science and applied risk science

- Welfare economics
- Experimental economic research

7.3 Department of Computer Science

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

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

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

7.4 Department of Electrical Engineering and Information Technology

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

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

Microelectronic and nanoelectronic components also enable the so-called System on Chip (SoC): the integration of complete microelectronic systems onto a single silicon chip has become feasible through the rapid development of CMOS VLSI technology. This demands cost-effective technology, application specific hardware/software architectures and highly efficient design methods. Other research areas include:

- Mechatronics – new functions through interdisciplinary research
- Energy at the cross roads of ecology and economics
- Fuel cells: a technology for the future
- Wireless communication: effective planning of transmitter networks

- Systems engineering: personal health monitoring
- Aviation and aeronautics
- Microelectronics, nanoelectronics and optoelectronics

7.5 Department of Chemical Engineering

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

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

7.6 Department of Civil Engineering, Geo and Environmental Sciences

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

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

8 Appendix

8.1 European Credit Transfer and Accumulation System

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

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

8.1.2 What are the primary aspects of ECTS?

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

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

8.2 Quality Management

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

8.2.1 Course evaluation

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

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

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

8.3 Admissions Regulations

The official " Satzung für den Zugang zu dem weiterbildenden Masterstudiengang Financial Engineering am Karlsruher Institut für Technologie" can be found 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 Service Management and Engineering und Financial Engineering" can be found here:
https://www.sle.kit.edu/downloads/AmtlicheBekanntmachungen/2017_AB_057.pdf

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

8.5 Fees Regulations

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

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