



Executive Master Program

Financial Engineering

Data Science, Machine Learning and Financial Technology

Technology + Management



The HECTOR School is the Technology Business School of the Karlsruhe Institute of Technology (KIT). It is named after Dr. Hans-Werner Hector, one of the co-founders of SAP SE.

The school aims to provide professionals with **state-of-the-art technological expertise and management know-how within part-time education programs**. The HECTOR School fosters lifelong learning within industry. Participants are supported in their career development with executive master degree programs, certificate courses, and customized partner programs.

The benefits of the executive master programs are numerous for participants as well as for the companies they work for:

- **Unique Holistic Approach:** A combination of technology expertise and management know-how.
- **State-of-the-Art Knowledge:** Direct transfer from the Karlsruhe Institute of Technology (KIT) research.
- **Part-Time Structure:** Allows participants to continue with their demanding careers whilst acquiring new skills.
- **Master Thesis to set up Innovation Projects:** Companies gain outstanding added value through the consultation of such projects by professors from KIT.
- **Excellent Networking Opportunities:** Professional networking is fostered across industries and on an international scale.



Portrait of the HECTOR School



Key Facts: Part-Time Master of Science (M.Sc.) Programs

Program Structure

- Part-time, 10 x 2-week modules
- Duration: part-time lecture period of ~15 months
- Master thesis: project work in the company, 6 months
- 5 Engineering and 5 Management Modules
- Teaching language: English
- Yearly program start: October

Academic Degree

Master of Science (M.Sc.) from the KIT (90 ECTS)

Admission Requirements

- A first academic degree: e.g. Bachelor, Master or Diploma
- At least 1-2 years work experience (depending on the level of the first degree, recommended > 3 years)
- If English is not your mother tongue nor has it been the language of instruction for the last five years, language proficiency is required, e.g. test certificate (e.g. TOEFL score of at least 570 PBT; 230 CBT; 90 iBT or IELTS at least 6,5 points) or appropriate proof of C1 level.

Accreditation

The KIT is system-accredited by AAQ. All HECTOR School master programs are accredited by the internal quality assurance system of the KIT.



Master Program

Financial Engineering (FE)

DIGITAL TRANSFORMATION
OF FINANCIAL SERVICES
INNOVATION & PROJECTS
RISK MANAGEMENT
FINTEC & INSURTECH
FINANCIAL MODELLING
WITH PYTHON SEMANTIC
TECHNOLOGIES ASSET
MANAGEMENT WITH AI
DERIVATIVES
STRATEGY & PEOPLE
FINANCIAL MACHINE LEARNING
SMART BETA PORTFOLIOS
BIG DATA AND ANALYTICS
DECISION & RISKS
CORPORATE FINANCE
DATA - DRIVEN
TRADING STRATEGIES
FINANCIAL DATA SCIENCE

Machine learning is changing nearly all aspects of our lives. Today algorithms execute tasks that until recently only human experts were able to perform. Especially in the financial industry, these developments led to a disruptive change in business models and technology (FinTech and InsurTech) and thus to dramatically transformed risk and investment processes. These new challenges come along with new job opportunities that require a completely new set of skills. Nowadays thorough data science, engineering and programming skills are essential to nearly every task in the risk and investment industry.

In order to prepare you for such tasks, our Master's program in Financial Engineering offers you a unique combination of finance theory, engineering methods, management tools, mathematical and computational techniques – blended with new developments from the field of artificial intelligence and Big Data. Our master's program exposes you to these techniques in a practical way, with a focus on hands on applications implemented in the Python programming language.

The Karlsruhe Institute of Technology (KIT) provides an ideal interdisciplinary environment with its long tradition of



Prof. Dr. Marliese Uhrig-Homburg
Chair of Financial Engineering and Derivatives, KIT

Prof. Dr. Martin E. Ruckes
Institute of Finance, Banking, and Insurance, KIT

Program Directors FE

"The digitalization is not only changing today's society but also companies' business models, in particular of the financial industry. Constantly new challenges emerge while progress in quantitative tools and computer technology open up entirely new opportunities. In order to successfully manage these opportunities, professionals from the technology- financial- and insurance industry need a thorough working knowledge of modern finance and information technology concepts, as well as a good understanding of essential engineering and management tools. The Financial Engineering Masters program of the Hector School offers a fine selection of finance, technology and management classes to prepare you to lead the transformation of the financial industry."
Prof. Dr. Marliese Uhrig-Homburg

interdisciplinary programs. Building on the long-established reputation for excellence in business engineering, the two-part program combines in-depth knowledge and understanding of fundamental concepts in business, finance, management, and technology.

Due to the pace of financial innovations, the need for highly qualified people trained in the area of financial engineering and technology is increasing. Whether you aim to contribute to a financial start-up or an innovation lab of a well-established firm, or whether you see yourself progressing in a more classical track in treasury, banking, finance, insurance, venture capital or consulting, the mix of finance, engineering, technology, and programming prepares you for the challenge.

Additionally, the Financial Engineering Program shares five management modules with the other master programs. This fosters cross industry networking and provides the participants with cutting-edge knowledge in technology-driven innovation, strategy, data-driven marketing, international multi-project management, as well as international law, human resource management, people analytics, and different leadership approaches.

Engineering Modules (EM)

Combine Technology and Finance to Manage FinTech Innovations



EM 1: Digital Platforms

The module enables participants to understand and design 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 trade-offs between standardization and flexibility and know how to leverage digital platforms in organizations in order to find a good balance. 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 introduces key concepts and technologies of the Internet of Things (IoT) as an enabler for realizing contemporary digital platforms.

EM 2: Economics of Global Financial Markets

In the last years, modern asset management is experiencing a disruptive transformation. Investment decisions executed by humans are replaced by algorithmic and machine learning software that offers optimized portfolio solutions to investors and customers. These new services come at an incredibly low fee and thus are able to provide sophisticated investment strategies to the broader public. Key to this promising new technology is a thorough understanding

of financial markets and portfolio optimization algorithms as well as the technical challenges in setting up such an automated system.

It is the goal of this module to provide that economic understanding of key financial concepts. This module introduces theoretical and empirical insights to understand global financial markets. The main focus is on building valuable intuition that later can be connected with technology to further advance FinTech innovations.

Participants will understand the main risk/return characteristics of equity and fixed-income markets from a conceptual and empirical point of view. There are scientific reasons for why equity beats bond investments in the long-run, and why it is even more advantageous to combine both asset classes into a single portfolio.

EM 3: Massive Data Sets and Machine Learning for Financial Engineering

This module deals with the technological and machine learning aspects of information and knowledge management. The module is divided into two parts. One part lays the foundation for advanced financial machine learning applications. The second part conveys recent technological advancements in information and knowledge management, semantic web services, Big Data, Data Science and cloud Infrastructure.

The foundation for the financial machine learning applications lays out the core concepts necessary to understand how machines learn about return predictability and hidden risks. Students learn concepts to uncover unknown risk and return drivers in small and massive data sets. These concepts are applied and tested with real world data and the Python programming language.

The information technology aspect focuses on data and information management, on the one hand, and on Big Data, on the other hand. The first aspect teaches students practical tools for state-of-the-art semantic web- and web 2.0-technologies, with a focus on the application in corporate environments. The second aspect of Big Data deals with current technical challenges and opportunities when working with massive datasets in a cloud and distributed context.

EM 4: Advanced Finance Theory

In this module, students dive into advanced finance concepts that are of utter importance for transforming the financial industry. Concepts cover corporate finance theory and the pricing and hedging of derivative securities. The corporate finance perspective focuses on how to manage and optimize the financing structure and the dividend policy of corporations. The section on option pricing provides a unified approach to the pricing and hedging of derivative securities.

EM 5: Financial Machine Learning with Artificial Intelligence

Every week new startups emerge that revolutionize the traditional financial industry through the combination of traditional finance concepts with modern AI applications. Particularly in the field of risk and asset management, sophisticated fully automated AI-driven systems take over the task of providing an intelligent portfolio composition to customers. This AI-driven disruption is one of the major developments in the area of financial technology (for both FinTech and InsurTech) with a huge annual growth rate in both assets under management and revenues. In this advanced module, students learn the newest methodologies and techniques to set-up their own robo advisor. To implement the basic structure students will use Python programming language.

Crash Course: Probability and Statistics

We highly recommend all applicants to participate in the course to update the technical knowledge, as it might be the crucial factor for a successful degree at HECTOR School.



Engineering Modules

EM 1: Digital Platforms

Courses: Enterprise Systems, IoT Technologies & Platforms, Market Engineering, Platform Economics

EM 2: Economics of Global Financial Markets

Courses: Financial Prototyping with Python, Managing Equity Risk, Managing Fixed Income Risk

EM 3: Massive Data Sets and Machine Learning for Financial Engineering

Courses: Tools for Financial Engineering, Data and Knowledge Engineering, Big Data Management

EM 4: Advanced Finance Theory

Courses: Corporate Financial Engineering, Derivatives

EM 5: Financial Machine Learning with Artificial Intelligence

Courses: Financial Modelling with Python, Financial Econometrics, Machine Learning for Risk and Asset Management

Curriculum may be subject to change.

Management Modules (MM)

Economic Know-How for Successful Managers



Management Modules

MM 1: Marketing & Information

Courses: Designing and Selling Solutions (incl. Negotiation Training), Information Systems Management, Big Data Methods, Legal Aspects of Information

MM 2: Finance & Value

Courses: Management Accounting, Financial Accounting, Strategic Financial Management, Case Studies

MM 3: Decisions & Risk

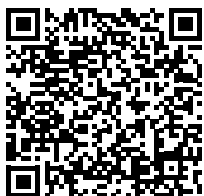
Courses: Decision Modeling, Risk Aware Decisions, Interactive Decisions, Robust and Stochastic Optimization

MM 4: Innovation & Projects

Courses: Technology Driven Innovation, International Intellectual Property Law, Project Management, Multi-Project Management in an International Setting

MM 5: Strategy & People

Courses: Strategic Management, Managerial Economics, Business Organization and Corporate Law, Strategic Human Resource Management, Leadership and Conflict Management



Curriculum may be subject to change.

Order your free course guide book with detailed contents of the Master's Program!

MM 1: Marketing & Information

Many of today's most successful businesses excel in satisfying customer needs because their decisions are based on data instead of good feeling. This is what this module is about: One focus is on how to use data for designing customer solutions (and get paid according to their value) and the other focus is a more general one at issues surrounding the use of (big) data for business decision-making.

MM 2: Finance & Value

Modern corporate governance is based on the creation of values. In the Finance & Value module, students learn essential methods of measuring, processing, and communicating the value added by corporate decisions that enable effective planning, management, and monitoring of corporate activity and corporate units. External value-based communication makes it possible to win stakeholders who are committed to the company over the long term.

MM 3: Decisions & Risk

Management implies making decisions. A valid data warehouse forms the basis for these decisions. The aim of this module is to give students a toolkit of various quantitative decision-making models so that the possibilities and limitations of methodical decision-making support (among others also optimization methods) can be used efficiently in the day-to-day running of projects.

MM 4: Innovation & Projects

Numerous paradigm shifts are currently being driven by the development and extensive use of new technologies. Profound changes in rapidly changing markets flow directly from this. Consequently, apart from classic project management, new management tools and methods are required because agility and innovation are some of the success factors in the current business climate. The module thus focuses on one of KIT's unique selling points: technology-driven innovation.

MM 5: Strategy & People

The key to corporate success lies in the correct strategy. But how do you recognize opportunities, develop a viable concept, and successfully implement it? In times of scarce human capital, it is more important than ever before to ensure employees are a perfect fit for their position and to motivate them to implement the strategy together. The module imparts state-of-the-art management techniques and know-how on evidence-based human resources management, people analytics, and leadership approaches.

A HECTOR School Master: Leadership Know-How for Demanding Careers.



»The Master's degree course in Financial Engineering imparts Game Changer knowledge. The current methods and application scenarios of Big Data and Data Analysis for topics such as Machine Learning and Artificial Intelligence change entire business models and they are part of the Program. Particularly noteworthy are the lectures about Financial Modelling with Python that cover theoretically models as well as the practical implementation. For many industries and finance departments today, the knowledge of Financial Econometrics imparted in the Master FE, is a key factor for future success and the application of statistical methods concerning capital markets, financial institutions and corporate finance & governance is important to control.«

Philipp Kunst, Financial Engineer Risk,
Valuation and Simulation at BearingPoint GmbH



More Alumni Voices

Academic Calendar

| September 2021 | | | | | | | October 2021 | | | | | | | November 2021 | | | | | | | December 2021 | | | | | | |
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| 06 | 07 | 08 | 09 | 10 | 11 | 12 | MM1 | 06 | 07 | 08 | 09 | 10 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | EM1 | 17 | 18 | 19 | 20 | 21 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | | | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 28 | 30 | | | | | | 27 | 28 | 29 | 30 | 31 | | |

| January 2022 | | | | | | | February 2022 | | | | | | | March 2022 | | | | | | | April 2022 | | | | | | | | |
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| 03 | 04 | 05 | 06 | 07 | 08 | 09 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | | |
| EM2 | 12 | 13 | 14 | 15 | 16 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | | |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | MM2 | 23 | 24 | 25 | 26 | 27 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | | |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 | 28 | | | | | | MM3 | 30 | 31 | | | | | 25 | 26 | 27 | 28 | 29 | 30 | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| May 2022 | | | | | | | June 2022 | | | | | | | July 2022 | | | | | | | August 2022 | | | | | | |
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| 02 | 03 | 04 | 05 | 06 | 07 | 08 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | EM4 | 06 | 07 | 08 | 09 | 10 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | |
| EM3 | 11 | 12 | 13 | 14 | 15 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 | 27 | 28 | 29 | 30 | | | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 29 | 30 | 31 | | | | |
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| September 2022 | | | | | | | October 2022 | | | | | | | November 2022 | | | | | | | December 2022 | | | | | | | | | | |
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| 05 | 06 | 07 | 08 | 09 | 10 | 11 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | MM5 | 07 | 08 | 09 | 10 | 11 | | | | | |
| MM4 | 14 | 15 | 16 | 17 | 18 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | | |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | | | |
| 26 | 27 | 28 | 29 | 30 | | | EM5 | 26 | 27 | 28 | 29 | 30 | 28 | 29 | 30 | | | | | 26 | 27 | 28 | 29 | 30 | 31 | | | | | | |
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- MM Management Modules
- EM Engineering Modules
- Exams

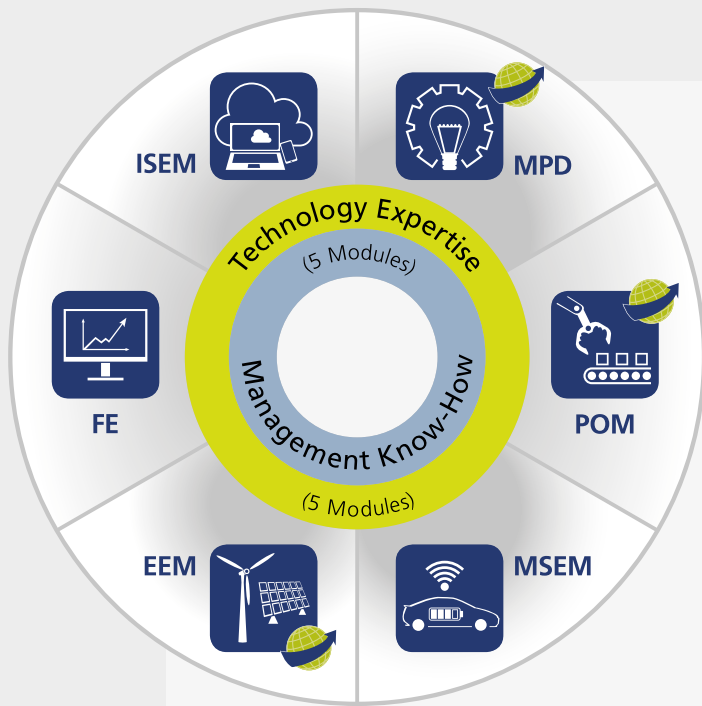
Crash Course
2-day seminar in "Probability and Statistics"

The academic calendar for each program starts annually in October. It consists of 10 modules, each with a duration of 2 weeks. All programs conclude with a master thesis.

>> **Master Thesis:** 6 months project work

Please note: Dates are subject to change.

More Master Programs



Six Part-Time Master of Science Programs in



- Management of Product Development (MPD)
- Production & Operations Management (POM)
- Mobility Systems Engineering & Management (MSEM)
- Energy Engineering & Management (EEM)
- Financial Engineering (FE)
- Information Systems Engineering & Management (ISEM)

Compact further education formats like Certificate Courses and more can be found in the HECTOR School Academy.



= International Module

HECTOR School of Engineering & Management

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Meet us

