DISTANCE LEARNING PROGRAMME
MASTER OF SCIENCE

STUDY GUIDE

FINANCIAL ENGINEERING

- FINANCIAL MATHEMATICS
- INTEREST RATE MODELS
- FINANCIAL DECISION MAKING
- ECONOMICS OF BANKING
- INSURANCE MATHEMATICS
- RISK MEASURES AND RATING SYSTEMS
- FINANCIAL STATISTICS
- COMPUTATIONAL METHODS IN FINANCE AND MORE
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We would like to thank you for your interest in the distance learning programme "Financial Engineering" and present you with this study guide.

The aim of this study guide is to answer the most important questions you may have about our distance learning degree programmes. It will provide you with an overview of the organisational processes including, e.g., information on applications, graduation and programme content. In the first sections, you will receive general information about how the academic programmes are organised as well as the relevant formalities and procedures. Then, we will present the necessary examination prerequisites and components, content of the programme and information on the authors of the learning materials.

The final section includes general information on the Technische Universität Kaiserslautern (TUK). We hope that this guide will provide you with all the necessary information and help you make an informed decision about your future distance learning degree programme.

Prof. Dr. Jörn Saß
Technische Universität Kaiserslautern (TUK)
Department of Mathematics
Scientific Head of the Distance Learning Programme "Financial Engineering"
CHARACTERISTICS OF ADVANCED SCIENTIFIC TRAINING

WHAT CHARACTERISES ADVANCED SCIENTIFIC TRAINING?

ADVANCED SCIENTIFIC TRAINING
- assumes an ability to study,
- assumes experience in scientific and academic work,
- expects a willingness to discuss other viewpoints,
- uses scientific language that is not always immediately accessible to a lay audience,
- expects a willingness to reflect on and interact with other linguistic forms and ways of thinking.

Do not expect easily „consumable“ or „digestible“ knowledge. Advanced scientific training imparts scientific theories as well as sound strategies and tools that can be reflected on and applied in your own professional career.

The field of advanced training offers a whole range of different training opportunities. They can be distinguished by, e.g., their different target audiences. Some courses do not require any special educational prerequisites and can be taken by any interested and willing applicant. Other providers of advanced training, however, develop special courses that are aimed at a select group of people.

This limitation is due to the fact that some educational programmes require a certain degree of prior knowledge for successful completion. This also applies to „advanced scientific training“.

Even though, in principle, no one should be excluded from insights and knowledge gained through science and research, it is nonetheless impossible to waive certain requirements for participation. In general, this includes a willingness to acquire the language of science. In particular, however, applicants require the basic scientific knowledge of the respective subject to be studied.
OBJECTIVES, STRUCTURE AND ORGANISATION

DISTANCE LEARNING PROGRAMMES AT DISC: „INDEPENDENT LEARNING“

Distance learning programmes are basically defined by the fact that students do not physically attend the institution of higher education but, instead, the institution of higher education comes to them. The notion of „independent learning“ is fundamental to the design of advanced distance learning programmes at DISC. Our students become experts of their own learning process, which results in a sustainable consolidation and increase of their domain-specific knowledge.

The DISC concept is essentially based on self-study phases that are consolidated and enhanced through on-campus phases. Both programme organisation and the didactically prepared learning materials and formats are based on the concept of independent learning. Each academic programme has its own virtual learning environment in the online campus that accompanies students for the duration of their programme and includes the following elements:

Self-study material, specifically developed for this academic programme, includes: substantiated and practice-oriented content, learning and reflection tasks with exemplary solutions, and tips for further reading. Relevant texts and additional learning materials are available for students online. Key, text-based learning materials can be accessed through the print-on-demand service: You can commission one of our printing service providers to print, bind, and send you the materials.

Supervised online learning
The self-study phases are supervised in the online learning environment. The following interaction, communication and information channels are available:
- Communication forum for exchanges with peers and supervisors;
- Organisation of programme: information on examination prerequisites and components (e.g. information on writing an Master’s thesis), registration for on-campus/face-to-face contact sessions, overview of dates and deadlines, submission of coursework and assessments.

Depending on the academic programme and semester, some compact courses, such as online seminars, colloquia or tutorials, may also be held in the online environment. These services are contingent on the requirements of the programme and learning objectives.

The aim of on-campus phases, which take place once per semester on a weekend, is to consolidate the learned content and take examinations.

OBJECTIVES OF THE DISTANCE LEARNING PROGRAMME

In-depth knowledge of modern financial mathematics and actuarial theory and their statistical and numerical use in practice are increasingly important in the finance and insurance industry. Regulators now also set strict risk assessment requirements for business portfolios, and these require an understanding of the latest statistical methods and actuarial models. A combination of methods is key in practice, but this demands comprehensive mathematics qualifications in all areas. The programme is tailored to the demands of every-day working practice: interdisciplinary, and designed to teach the advanced financial mathematics and financial economics theory and skills required for an in-depth understanding of the increasingly complex financial market. It also explores links to actuarial science and teaches relevant statistical and numerical methods.

TARGET GROUP

The programme is aimed at graduates of mathematics programmes or graduates of other programmes whose initial degree had a significant mathematics component who want a more in-depth understanding of financial mathematics and to learn about the background, concepts and methods and are seeking a career in applied financial mathematics or research.

PROGRAMME DURATION

The standard period of study in the distance learning programme “Financial Engineering” is six semesters, including examinations. Students require a total of 90 credit points to complete the programme. The programme starts in October every year.
ADMISSION REQUIREMENTS

1. ADMISSION WITH A UNIVERSITY DEGREE

Applicants must demonstrate that they have completed a higher education degree lasting at least six semesters at a German or foreign state or state-recognised higher education institution, at least one year’s relevant work experience in the finance and insurance sector or in a mathematics-related profession following their degree, and that they have the necessary prior knowledge from their previous degree. Prior knowledge from applicants’ previous degrees is demonstrated using a scoring system and by the successful completion of module assessments in analysis and stochastics. Students may be able to catch up with some aspects required during the first year of the programme (conditions of admission); details are available on our website at www.zfuw.de/application

2. ADMISSION WITH A PROFESSIONAL QUALIFICATION

Prospective students without an undergraduate degree but with at least four years’ relevant professional experience in finance and insurance can take an aptitude test for admission to the programme. They may have to complete credits in analysis and stochastics in the first year of the programme (conditions of admission); details are available on our website www.zfuw.de/entrancequalification

APPLICATION & ENROLMENT

A period of several weeks, generally from mid-May to mid-July, is set for applications. New intake is in the winter semester only. Please contact the DISC or the Student Affairs Office at the TUK for details of the current admission dates and application deadlines. They will also provide the necessary forms and documents for applications. For more detailed information on registration, please go to: www.zfuw.de/application

Successful applicants will be sent detailed information on registration. Separate conditions apply for candidates with professional experience but no university degree. All information is available at: www.zfuw.de/entrancequalification

STUDY INTERRUPTIONS

You can discontinue or interrupt your distance learning programme at the end of each semester. The associated certificates of de-registration or leave of absence will also be issued at the end of the semester. The registration fee and the tuition fee cannot be reimbursed in the case of withdrawal after successful admission to the programme. Many students experience periods in which they need to focus more strongly on their careers or families while enrolled in an academic programme. Experience has shown that it is nonetheless possible to successfully graduate from the programme despite other commitments. Contact the programme officers in time so that they can potentially help you to find an individual solution in order to avoid interrupting or even discontinuing your academic programme.

COSTS

The current tuition fee for the advanced distance learning Master’s programme “Financial Engineering” is 1,990 Euro per semester (plus the registration fee of currently 102 Euro per semester) as well as a one-time fee for the Master’s degree of currently 500 Euro. In accordance with the applicable DISC fee structure, tuition fees are reduced to 30 percent as of the third semester exceeding the standard period of study. This does not apply to the fee for the Master’s thesis. This covers, among other things, the costs for online learning materials, on-campus phases and administrative fees.

Furthermore, you can also use our online learning environment to commission one of our printing service providers. For a surcharge, they will print, bind and send you the available learning materials (print-on-demand). Additional costs that are not included in the tuition fee may be incurred due to the on-campus phases (bed, board, transport, etc.).

Tuition fees are charged every semester, depending on your enrolment or re-registration status. If you are enrolling for the first time, it is very important that you do not transfer the tuition fee until you have received your letter of admission.

We try to ensure that our study guide is always up-to-date. Despite regular revisions, information on costs and programme content may deviate due to short-term amendments. We therefore kindly ask that you visit our website for information on the current programme conditions prior to submitting your application.

FINANCIAL SUPPORT

The state offers individual tax incentives in Germany for advanced training measures. Depending on your personal income and job situation, you may be able to offset the costs of your distance learning programme as advertising expenses or special expenses and receive a partial or full refund. For more information, please contact an independent expert or your local tax authority. Unfortunately, financial support cannot be granted in accordance with the Sozialgesetz – Drittes Buch (SGB III) (Social Security Code – Book Three) or the Bundesausbildungsförderungsgesetz (BaFG) (Federal Training Assistance Act). Further information on support measures can be accessed at www.zfuw.de/sponsorship as well as in the DGWF brochure „Fördermöglichkeiten in der Weiterbildung“ (Support measures for advanced training), which is available in the download area (in German only).

Please also consult with relevant authorities in your home country or international organisation for information on additional support measures.

DISADVANTAGE COMPENSATION

Students with disabilities or severe disabilities can receive disadvantage compensation to counterbalance disability-related disadvantages. Disadvantage compensation is normally only granted once students submit proof of a severe disability as well as further conditions (marks). For more information, please contact the programme officer.
FAMILY SUPPORT

Many students are also parents and want to combine their family life with their academic programme or career. The TUK is dedicated to improving the conditions for reconciliation of academic programme/science and family life.

Experience has shown that forming voluntary learning groups is beneficial to our students. In these groups, students can regularly discuss the learning materials and help each other prepare for examinations. Our online learning environment also supports students in organising car pools and founding learning groups either at the beginning of the academic programme or during your programme's kick-off event.

Our services include, among other things, an appealing family room that can be used by parents who study or work at the TUK as well as by students in distance learning programmes during the on-campus events. Furthermore, we offer free online courses such as e.g. „Work-Life-Learn-Balance". For more information, please contact the programme officer.

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WORKLOAD

Students take various classes towards two modules in each of the first five semesters. Students work through one to two sets of learning material for each module. The sixth semester is for the Master's thesis. Around 16-18 hours per week will be required for working through the learning material and completing the corresponding exercises. Students should schedule this time especially in the first semester, as it generally takes a while for them to establish their own individual working and studying style and to get used to the written course material. Realistically, the initial workload is likely to be higher, not least for those from non-mathematical disciplines: they will need to familiarise themselves with a new and perhaps strange terminology and style, and new types of question. Your actual workload will depend on a range of very different factors such as prior knowledge, your individual studying habits and your professional and personal situation. One weekend (Friday to Sunday) per semester is required on top of the specified workload for attendance at the on-campus phase. Whatever your actual workload, you will find that you will not be able to pursue all your previous activities and hobbies as usual. We therefore recommend realistically considering your capacity, your interests and the time available to you to avoid unnecessary frustration.

On-campus phases are the chance to explore course content in more depth, to ask any questions about the content of the learning material, and to discuss the implementation and practical application of the methods about which you have learned. Written examinations and oral examinations (presentations) are also held during the period of the on-campus phases. On-campus phases require students' active participation.

Students are responsible for their accommodation and catering arrangements for the on-campus phases; however, we will be happy to help with your accommodation search.

ON-CAMPUS PHASES

An on-campus phase is held for all students on the distance-learning programme towards the end of each of the first four semesters. Attendance at these on-campus phases is mandatory. The on-campus phases run from Friday lunchtime to Sunday afternoon. On-campus phases in the winter semester are generally held in February/March and on-campus phases for the summer semester in August/September.

On-campus phases are the chance to explore course content in more depth, to ask any questions about

Experience has shown that forming voluntary learning groups is beneficial to our students. In these groups, students can regularly discuss the learning materials and help each other prepare for examinations. Our online learning environment also supports students in organising car pools and founding learning groups either at the beginning of the academic programme or during your programme's kick-off event.

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ONLINE LEARNING ENVIRONMENT & LEARNING MATERIALS

The online learning environment is a central component of the distance learning programme and provides, e.g., information on important semester dates and organisation of the distance learning programme as well as examinations, access to materials, and an opportunity to connect with other students. All learning materials are uploaded to the online environment and students can register for the on-campus contact sessions here as well. You also have the possibility to discuss and connect with other students here.

The written learning materials were developed specifically for the distance learning programme and constitute a key component of independent self-study. For this reason, the documents have a self-explanatory structure. The materials include all significant factual information on the topic and have been didactically and formally designed in such a way as to enable independent and autonomous knowledge acquisition.

For enrolled students, the learning material is available online as a PDF download. You can also use our print-on-demand service to commission one of our printing service providers to print, bind, and send you the materials. Our distance learning students can find the materials on the password-protected learning platform OpenOLAT. You can access the respective semester’s necessary documents after the beginning of the semester.

STRUCTURE OF THE LEARNING MATERIALS

After the table of contents, there is a brief introduction to the team of authors and an explanation of the learning outcomes. Knowing the learning outcomes is key to studying on distance-learning courses. The actual course texts then follow.

The course texts include definitions, theorems, proofs, examples and motivational texts. They build on the content prerequisites for the module, which can be found in the module handbook, and introduce all new objects and theories in detail. Examples illustrate new definitions and statements, and prepare students for the module exercises for submission, which take the form of either coursework or assessments. The course texts also include information on further recommended reading, which is listed at the end of the learning material.

GRADUATION

Once you have completed all the requirements for the “Financial Engineering” programme, you will be awarded a “Master of Science” (M.Sc.) diploma.

THE SUCCESSFUL COMPLETION OF THE MASTER’S PROGRAMME “FINANCIAL ENGINEERING” IS CERTIFIED BY THREE DOCUMENTS:

> transcript of grades
> certificate of the award of the academic degree "Master of Science" (M.Sc.) with the overall grade
> Diploma Supplement in English

A Diploma Supplement is issued by most universities in the European Union to provide an overview of the university and grading structure within each country along with explanatory information about each specific university’s course requirements and grading methods.
The course teaches advanced financial mathematics theory and practical skills, and provides an in-depth insight into the related fields of actuarial science, statistics, computer-assisted methods and financial economics. This gives students a comprehensive understanding of the increasingly complex financial markets.

PROF. DR. JOHAN SALS
SCIENTIFIC HEAD
# Financial Engineering

## OverView of Modules

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<td>Insurance Mathematics</td>
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<td>2. Semester</td>
<td>Financial Mathematics</td>
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<td>3. Semester</td>
<td>Interest Rate Models</td>
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<td>4. Semester</td>
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<td>Computational Methods in Finance (second part)</td>
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PROGRAMME CONTENT

MODULE CONTENT

M1: INTRODUCTION TO FINANCIAL MATHEMATICS
Authors: Dr. Martin Bracke, Dr. Sascha Desmettre, Prof. Dr. Jörn Saß, Dr. Stephanie Schwaar

There are two sets of learning material for this module. „Introduction to MATLAB for Probability and Statistics“ gives an introduction to MATLAB for stochastics, so that students can then use MATLAB to apply the methods that they learn in the course of the degree. The aspects covered by „Probability Concepts for Finance“ include:
- Modeling and pricing in discrete-time financial markets
- Probability concepts and their applications

M2: INSURANCE MATHEMATICS
Authors: Prof. Dr. Ralf Korn, Prof. Dr. Jörn Saß

The learning material covers topics from the fields of life insurance and non-life insurance mathematics, including:
- Mortality
- Insurance benefits
- Inclusion of costs
- Joint life insurance

M3: FINANCIAL MATHEMATICS
Authors: Prof. Dr. Ralf Korn, Prof. Dr. Jörn Saß

Topics covered by the learning material include:
- Basic stochastic analysis
- Diffusion model for asset prices and trading strategies
- Complete markets

M4: ECONOMICS OF BANKING
Author: Prof. Dr. Jan Wenzelburger

Questions explored in the learning material include:
- What is a bank, and what are its core activities?
- Why do banks exist?
- The theory of the bank as a firm
- Banks as portfolio managers

M5: INTEREST RATE MODELS
Authors: Prof. Dr. Jörn Saß, Prof. Dr. Frank Seifried

Topics covered by the learning material include:
- The fundamentals of interest modeling
- The Heath-Jarrow-Morton framework
- Spot rate models
- Bonds carrying default risks (Merton model)

M6: FINANCIAL DECISION MAKING
Authors: Prof. Dr. Jörn Saß, Prof. Dr. Jan Wenzelburger

Topics covered by the learning material include:
- The pricing of financial derivatives
- Risk aversion
- Multi-period planning horizons
- Continuous-time portfolio optimisation
- Martingale method in complete markets
- Stochastic control

M7: RISK AND STATISTICAL MODELING
Authors: Prof. Dr. Jörn Saß, Dr. Jean-Pierre Stockis

There are two sets of learning material for this module. „Risk Measures and Rating Systems“ covers topics including:
- Preferences and expected utility
- Axiomatic introduction and estimation of risk measures
- Credit default risks and risk-based insurance premiums
- Portfolio optimisation under risk constraints

„Financial Statistics“ covers topics including:
- Models and estimation techniques for financial time series
- Copulas and their use in risk management
- Stochastic methods for estimating the probability of extreme events

M8: COMPUTATIONAL METHODS IN FINANCE
Author: Prof. Dr. Ralf Korn

Topics covered by the learning material include:
- Model selection and calibration
- Approaches to option pricing
- Pricing of exotic options and certificates
- Selected aspects of Monte Carlo simulations
- Convergence of stochastic processes
LIST OF AUTHORS

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DEPARTMENT & SCIENTIFIC HEAD

Prof. Dr. Jörn Saß has been a member of the Financial Mathematics Group at the TUK since 2008. For the first five years, he held the Deutsche Forschungsgemeinschaft Heisenberg Chair. He previously held posts at UBC in Vancouver, Canada and at RICAM in Linz, Austria.

His research specialisms are in financial and actuarial mathematics and in related areas of statistics. He focuses in particular on determining solutions and their explicit structure for portfolio optimisation under constraints, for example under transaction costs, in incomplete markets and under risk constraints. His research fields also include option pricing, parameter estimation and actuarial equilibrium models.

The Financial Mathematics Group is part of the Department of Mathematics at the TUK and also includes Prof. Dr. Ralf Korn. Prof. Dr. Ralf Korn’s research specialisms in financial mathematics are portfolio optimisation, stochastic control, computational finance and Monte Carlo methods. The Department of Mathematics has a total of eleven working groups in four different fields of teaching and research.

Students at Kaiserslautern can therefore choose from the full range of mathematical specialisations, from theoretical to applied. Nowhere else offers such a wide range of options alongside a traditional mathematics degree to learn about mathematics as a key technology of the twenty-first century, and to combine theory and practice.

Close collaboration with the Fraunhofer Institute for Industrial Mathematics (ITWM), founded in 1995 as a spin-off from the Department of Mathematics, gives students a unique insight into practice as part of their degree. One of the key partners of the Financial Mathematics Group is the Financial Mathematics Department at ITWM. This partnership and the number of chairs in financial mathematics and stochastics at Kaiserslautern allows us to offer in-depth mathematical qualifications in the field of financial mathematics with a strong link to practical requirements. What is more, these resources mean we have the teaching staff here to run all classes on the distance-learning Financial Engineering Masters.
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PARTICIPATING INSTITUTIONS

DISTANCE AND INDEPENDENT STUDIES CENTER

The DISC was founded as the Zentrum für Fernstudien und Universitäre Weiterbildung in 1992 and is a key scientific department of the TUK. The DISC incorporates the three areas: Zentrum für Fernstudien und Universitäre Weiterbildung (ZFUW, Center for Distance Studies and Advanced University Training), eTeaching Service Center (eTSC) and Selbstlernzentrum (SLZ, self-directed study center) that each addresses the overarching range of DISC tasks in various fields: distance learning, e-teaching support and self-study skills.

The range of measures that are offered in cooperation with the individual subjects and departments at the TUK include postgraduate distance learning programmes of varying duration and with different degrees. All distance learning programmes can be taken as dual study programmes. More than 4,300 students from Germany, Europe and the rest of the world are currently enrolled in the following academic programmes:

**“HUMAN RESOURCES” DEPARTMENT**
- Adult Education (Master of Arts)
- Human Resources Development (Master of Arts)
- Organizational Development (Master of Arts)
- School Management (Master of Arts)
- Social Sciences: Organisation and Communication (Master of Arts)
- Systemic Consulting (Master of Arts)
- Systemic Management (Certificate)

**“MANAGEMENT & LAW” DEPARTMENT**
- Commercial Law for Business Practice (Master of Laws)
- Economy and Management (Master of Arts)
- Management of Cultural and Non-Profit Organisations (Master of Arts)
- Management of Health and Social Institutions (Master of Arts)
- Master of Evaluation (Master of Arts)
- Sustainable Development Cooperation (Master of Arts)
- Tax Law for Business Operations (Master of Laws)

**“SCIENCE & ENGINEERING” DEPARTMENT**
- Financial Engineering (Master of Science)
- Fire Protection Planning (Master of Engineering)
- Medical Physics (Master of Science)
- Medical Physics and Engineering (Certificate)
- Nanobiotechnology (Certificate)
- Nanotechnology (Master of Science)
- Psychology of Developmental and Learning Disorders in Children (Master of Science)
- Software Engineering for Embedded Systems (Master of Engineering)

Additional to the above mentioned academic programmes the DISC offers certificate courses. We are constantly increasing our range of offered programmes. Further information is available at www.zfuw.de.
As a campus university with around 14,700 students, the TUK offers approx. 100 future-oriented degree programmes in twelve departments. The manageable size of the university also guarantees students close contact to professors and outstanding support. The TUK has a lot to offer its students, including a multitude of attractive degree programmes such as biophysics, biological or chemical engineering, food chemistry and engineering mathematics. Most degree programmes are interdisciplinary in nature and therefore unite various disciplines. A degree in a STEM subject (science, technology, engineering, mathematics) opens interesting and diverse career prospects.

The TUK enjoys an excellent international reputation in research and teaching. Students and (junior) scientists benefit from the numerous internationally renowned research institutions that cooperate closely with the TUK in the field of applied research. These include, amongst others, two Fraunhofer institutes, one Max Planck institute, the German Research Centre for Artificial Intelligence, and the Institute for Composite Materials.

KAISERSLAUTERN, AS A CENTRE FOR SCIENCE, IS ONE OF THE MOST SIGNIFICANT IT CLUSTERS IN EUROPE

The TUK is a member in the group “Universität der Großregion - UniGR” (University of the Greater Region). The other members are the universities in Lorraine, Liège, Luxembourg, Saarbrücken, and Trier. This means that TUK students can also benefit from, e.g., the range of courses offered at the partner universities. Further information: www.uni-kl.de/uni-gr

TECHNISCHE UNIVERSITÄT KAIERSLAUTERN

Students will also benefit from an appealing housing situation: There are more than 2,000 student rooms available in close proximity to the campus. All rooms naturally come with free internet. The Department of International Affairs/ISGS offers international students and scientists a broad range of support services to help them get settled at the TUK as quickly as possible. Junior scientists (e.g. doctoral candidates) are supported in their personal and professional development by the TU-Nachwuchsring (network for support of young scientists).

THE CAMPUS OF THE TUK ALSO HAS A LOT TO OFFER IN ADDITION TO PROFESSIONAL TRAINING

Thanks to the broad range of different sports and the variety of attractive excursions, the university’s sports programme has become a key component of recreational activities at the TUK. In the evening, students can attend concerts, the theatre, our cinema and various exhibitions on-campus. Furthermore, there are numerous student-led groups dedicated to most hobbies. The TUK’s event calendar also includes a variety of festivities, such as the summer ball or the summer party.

www.uni-kl.de
DO YOU HAVE ANY QUESTIONS?

CONTACT US. WE ARE HERE TO HELP.

Contact

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Subject to change and errors expected.

For more information on the distance learning Master's programme „Financial Engineering“, please go to:

www.zfuw.de