

## MSc in Risk Management

### Detailed Course Descriptions

#### Mandatory Courses

##### Block I

###### Financial Accounting

This course is designed to provide students with the skills required to interpret published financial statements. The course focuses on financial statements - income statement, balance sheet and cash flow statement; considers the crucial decision involved in preparing financial statements - revenue recognition, capitalization, valuation etc. It examines the incentives and constraints which influence the preparation of financial statements including the incentives to manage earnings; and introduces the interpretation of financial statements including ratio analysis.

3,5 Ects

###### Measure and Probability Theory

The aim is to provide the student with the necessary understanding of probability theory. The course treats the essential elements from Lebesgue measure theory, change of measure, limits, distributions, the central limit theorem, normal and non-normal distributions, extreme value theory, and copulas at a level understandable for the nonspecialist.

4 Ects

###### Financial Econometrics

After the completion of this course a student can independently analyze the stochastic features of financial time series. Topics covered include regression analysis, non-linear regression, ML, GMM, volatility models, time varying parameters, forecasting, Bayesian methods, simulation, and the bootstrap.

4 Ects

##### Block II

###### Stochastic Processes and Ito Calculus

The goal is to obtain a sufficient understanding of stochastic processes and stochastic calculus necessary for derivative pricing in continuous time. The course covers the most important stochastic processes in discrete and continuous time. Most emphasis is given to Brownian motion and general diffusions, but also jump processes are reviewed. The essential elements of Ito calculus are treated in such a way that the student obtains a thorough working knowledge.

4 Ects

###### Derivatives I

At the end of this course the student should be able to price standard derivatives and some of the exotics through the use of Ito calculus and risk neutral pricing. Students should also be able to implement numerical solutions in discrete time. Derivatives are a major contribution to risk in any

portfolio. It is essential to be able to price these assets well. The course provides an in depth treatment of derivative pricing by using no-arbitrage models. It considers standard derivatives but also more complex options like interest rate derivatives, credit derivatives, volatility derivatives, inflation related products, exotic derivatives, energy derivatives, cat bonds, securitization, counter party risk, and reinsurance treaties. A case study covers pricing with binomial trees. For practical purposes numerical approximations and hedging methods are discussed.

4 Ects

#### Asset Pricing

The goal of the course is to provide the students a broader knowledge of the main issues in the theory finance. The course covers the pricing of assets by pricing kernels and risk factors. Standard CAPM and APT models are reviewed. The advantages and disadvantages of diversifications are treated. Risk attitudes and risk premia are discussed.

4 Ects

### **Block III**

#### Actuarial Mathematics and Modelling

The student learns the main models that are used in actuarial science to price insurance premiums, to calculate the risk of default due to large claims and to provision for longevity. The course covers the key models used in life, and non-life insurance (large claim analysis) and pension provisioning. Important use is made of extreme value analysis. Yield curve risk and inflation risk are important economic factors to be discussed.

4 Ects

#### Enterprise Wide Risk Sources

The course covers the main risk categories and the analysis of those risks. The course discusses market risks, credit risks, operational and technology risks, political risks and actuarial risks. A comprehensive view as to how these risks can be managed is presented. Practical issues like aggregation problems come to the fore. Important use is made of extreme value theory. The main requirements set by supervisors and regulators, such as the IFRS, Basel II, FTK, Solvency II accords, are reviewed. Techniques and technology available for risk management are discussed.

4 Ects

#### Numerical Methods and Optimization

The course provides the student with a thorough working knowledge of practical optimization techniques. Static and dynamic optimization under constraints are the essential elements of this course. Emphasis is on dynamic optimization, including the Bellman principle, Euler equations and the maximum principle. Numerical methods for optimization problems in practice, including treatment of differential equations, receive ample attention. These analytical tools are essential for portfolio optimization and risk minimization under constraints.

4 Ects

### **Block IV**

#### Risk Management Techniques I

4 Ects

#### Derivatives II

This course gives an introduction to interest rate modeling in continuous time and the pricing of interest rate derivatives. We will cover the Black-model that is used by the market to quote the prices of standard products like caps/floors and swaptions. We treat short-rate models, such as the Hull-White and the CIR model. We treat market models, such as the LIBOR Market Model and the Swap Market

Model. Finally, we deal with the issues of pricing “exotic European” options using convexity correction techniques. Theory will be illustrated by cases in Excel and Matlab (or Scilab).  
4 Ects

#### Programming

To equip students with a working knowledge of programming necessary for risk management. Risk management cannot do without analyzing data and simulation. This requires a working knowledge of software programmes such as Ox, Matlab, Excel/VBA and some proficiency in programming. Students are required to develop core programming skills, implement these skills by writing programmes themselves, and develop versatility in switching between different programming languages depending on the structure of the research question at hand. Simultaneously with the programming skills, students develop a thorough knowledge of simulation and bootstrapping techniques.  
4 Ects

### **Block V**

#### Risk Management Techniques II

In this course, students go over the various aspects of credit risk modeling and the associated techniques. The course covers a wide range of issues ranging from credit scoring to credit portfolio modeling. For the former, limited dependent variable models are treated and their evaluation criteria. For the portfolio approach, we build on copula models as well as state-space modeling of multivariate time series (including point process methodology). Most of the machinery is developed under the physical measure. At the end of the course, however, the analogue under the risk neutral measure is studied for valuation and risk management of credit derivatives (both single name and basket derivatives).  
4 Ects

#### Applied Risk Management

This course gives the student experience with real life risk management and the course serves to generate ideas for the thesis research project. The course covers a real life case provided by the sponsors. It provides the student with insights into how the techniques of risk management are implemented in practice. Students use actual data, devise a simulation study, and test recent theory using the empirical techniques acquired during the programme. The results of the research project are presented in front of the panel of professional experts and academic staff.  
4 Ects

All courses offered by Duisenberg school of finance are subject to change.