



Stochastics and Financial Mathematics MSc

Vrije Universiteit Amsterdam - Faculteit der Exacte Wetenschappen - M Stochastics and Financial Mathematics - 2014-2015

The field of Stochastics covers the areas of science that are concerned with processes in which chance plays a central role.

Usually the field is subdivided into Statistics, Probability Theory and Stochastic Operations Research. Financial Mathematics is an important field of applications of stochastics. The mathematical point of view for questions in finance has its own virtue and is an interesting subject of research. In view of the relevance of the numerous areas of research in which stochastics is applied, and in view of the reach of these areas of research and their challenging theoretical problems, this master offers a broad spectrum of possible specializations. The theoretically inclined, as well as the more applied master student, will have the possibility to choose a program adapted to his/her personal interests.

The Korteweg-de Vries Institute for Mathematics (UvA) and the Department of Mathematics (VU) of the two universities in Amsterdam, and the Mathematical Institute of the University of Utrecht (UU) have joined forces to offer this two year master in Stochastics and Financial Mathematics. The program offers the possibility to specialize in Statistics, Probability Theory, Financial Mathematics or Stochastic Operations Research.

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List of Courses

Each student has to choose 67 European credits (EC) optional courses.

- at least 30 EC from the course list below and at least one Mastermath course (X_400323, X_418139, X_400339, X_400571)
- at most 25 EC can be chosen out of the programmes of Business Analytics and/or Econometrics and/or Mathematics
- at most 12 EC are free to choose

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator and approved by the Examination Board.

Vakken:

Naam	Periode	Credits	Code
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Bayesian Statistics	Periode 4+5	6.0	X_418147
Ergodic Theory	Periode 1+2	8.0	X_418138
Ergodic Theory and Fractals	Periode 4+5	6.0	X_418132
Forensic Statistics and Graphical Models	Periode 4+5	6.0	X_418018
High-dimensional Data Analysis	Periode 1+2	6.0	X_418148
Information Theoretical Learning	Periode 4+5	6.0	X_418019
Interest Rate Models	Periode 1+2	6.0	X_418091
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Mixed and Longitudinal Modeling	Periode 4+5	6.0	X_418149
Multivariate Analysis and Multidimensional Data Analysis	Periode 4+5	6.0	X_418150
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124
Percolation	Periode 1+2	8.0	X_418139
Portfolio Theory	Periode 1+2	6.0	X_400535
Probability on Graphs	Periode 4+5	6.0	X_418151
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Learning	Periode 1+2	4.0	X_418081
Statistics for Networks	Periode 1+2	6.0	X_405110
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes	Periode 4+5	8.0	X_400339

Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Survival Analysis	Periode 4+5	6.0	X_418152
Time series	Periode 4+5	8.0	X_400571

Compulsory Choice

Compulsory Choice (at least 1 out of 4)

Vakken:

Naam	Periode	Credits	Code
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Percolation	Periode 1+2	8.0	X_418139
Stochastic Processes	Periode 4+5	8.0	X_400339
Time series	Periode 4+5	8.0	X_400571

Compulsory Courses

Beyond the compulsory courses mentioned in the list below, students have to choose at least 6 EC in academic skill (including the course Scientific Writing in English).

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator and approved by the Examination Board.

Vakken:

Naam	Periode	Credits	Code
Master Project Stochastics and Financial Mathematics	Ac. Jaar (september)	36.0	X_400502
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Scientific Writing in English	Periode 4	3.0	X_400512
Seminar Mathematics	Periode 1+2	6.0	X_405024

Advanced Combinatorics

Vakcode	X_418135 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	500

Inhoud vak

This course is part of the joint national master programme in mathematics. For schedules, course locations and course descriptions see <http://www.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <http://www.mastermath.nl/registration/>

Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.

Asymptotic Statistics

Vakcode	X_400323 (400323)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

This course is part of the joint national master programme in mathematics. For schedules, course locations and course descriptions see <http://www.mastermath.nl>. Registration required via <http://www.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

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Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.

Bayesian Statistics

Vakcode	X_418147 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	500

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Ergodic Theory

Vakcode	X_418138 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	500

Inhoud vak

This course is part of the joint national master programme in mathematics. For schedules, course locations and course descriptions see <http://www.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <http://www.mastermath.nl/registration/>

Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.

Ergodic Theory and Fractals

Vakcode	X_418132 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	400

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Overige informatie

Docenten en beoordelaars zijn Prof. Dr. E.A. Verbitskiy (Leiden) en Dr. C.C.C.J. Kalle (Leiden).

Locatie: Universiteit van Leiden

Forensic Statistics and Graphical Models

Vakcode	X_418018 (418018)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	500

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Overige informatie

Docent en eerste beoordelaar is Prof. dr. R.D. Gill (Universiteit Leiden).

High-dimensional Data Analysis

Vakcode	X_418148 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	500

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Information Theoretical Learning

Vakcode	X_418019 (418019)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	500

Inhoud vak

The course description is available on:

<http://tinyurl.com/l6onvr4>

Doelgroep

mSFM

Overige informatie

This course will be given at Leiden University. For VU and other elective students: course registration must also be done at the first day of lecture directly with the lecturer.

Interest Rate Models

Vakcode	X_418091 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Docent(en)	prof. dr. G.J.B. van den Berg
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/14265.html>

Doelgroep

mSFM, mMath

Overige informatie

Course registration is compulsory via <https://www.sis.uva.nl>

Levy fluctuation theory, with applications in finance and OR

Vakcode	X_418077 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/en/c/12428.html>

Doelgroep

mSFM, mMath

Overige informatie

Course registration is compulsory via <https://www.sis.uva.nl>

Master Project Stochastics and Financial Mathematics

Vakcode	X_400502 (400502)
Periode	Ac. Jaar (september)
Credits	36.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	600

Doel vak

The objectives of the master project are:

- to explore a research problem in the area of Stochastics and/or Financial Mathematics, or to distill such a mathematical problem formulation from the context of the host organisation.
- to study relevant papers from the (mathematical) literature, to combine those, and to add an original contribution.
- to put the results and conclusions in proper perspective, also in relation to results obtained by others.
- to present the research both in writing and in an oral presentation.

Inhoud vak

The Master's programme is concluded by an internal or external master project.

An external project ("internship") is carried out within a business, industry or research facility other than the departments of Mathematics.

For an internal research project, the student starts by identifying a research topic in consultation with his/her supervisor. This leads to a research plan, which is recorded on the form that can be downloaded here: <http://www.few.vu.nl/en/current-students/study-guidance-and-contact/final-assessment-form/index.asp> (a copy is given to the master coordinator). The project itself usually starts with a literature study, leads towards the boundaries of mathematical knowledge, and ideally culminates in original research by the student. The work is carried out by the student individually, while there are weekly or biweekly meetings with the supervisor to discuss progress and scientific questions. The work is presented both in a master thesis and in an oral presentation (mandatory).

Onderwijsvorm

Either the student performs individual research or the student is an intern at a host organization.

Toetsvorm

Assessment is based on the research performed (level, quality, quantity, independence, etcetera), the written master thesis, and the oral presentation. The form used for the assessment of a research project can be downloaded here: <http://www.few.vu.nl/en/current-students/study-guidance-and-contact/final-assessment-form/>

Literatuur

assigned individually

Vereiste voorkennis

78 EC of the master program need to be completed before starting the final project

Doelgroep

mSFM

Overige informatie

If you are planning to start your external project within four months, please make an appointment with Annemieke van Goor (vangoor@few.vu.nl) at the Internship Office. Additional information can be found at <http://www.few.vu.nl/en/current-students/int-car/internships/index.asp>

Measure Theoretical Probability

Vakcode	X_400244 (400244)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

This course is part of the joint national master programme in mathematics.

For schedules, course locations and course descriptions see <http://www.mastermath.nl>.

Registration required via <http://www.mastermath.nl>.

Doelgroep

mMath, mSFM

Intekenprocedure

You have to register your participation in each Mastermath course via <http://www.mastermath.nl/registration/>

Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.

Mixed and Longitudinal Modeling

Vakcode	X_418149 ()
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Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	500

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Multivariate Analysis and Multidimensional Data Analysis

Vakcode	X_418150 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	500

Nonparametric Bayesian Statistics

Vakcode	X_418124 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/7984.html>

Doelgroep

mMath, mSFM

Overige informatie

Course registration is compulsory via <https://www.sis.uva.nl>

Percolation

Vakcode	X_418139 ()
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Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. van den Berg
Examinator	prof. dr. J. van den Berg
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak

The aim is to introduce classical results (computation of certain critical values) as well as more recent developments (e.g. conformal invariance; see course description below) in percolation theory. At the end of the course the student is expected to understand these results and to be familiar with the machinery developed in the course.

Inhoud vak

Percolation deals with the connectivity properties of large (in many cases infinite) networks, for instance a 'honeycomb' lattice, from which a certain fraction q of the nodes or bonds is randomly removed (coloured red) and the remaining part is coloured green. It is inspired by phenomena in physics and life sciences, but has become a mathematical topic of independent interest. It is one of the nicest examples of a system with critical behaviour: There is a critical value of the parameter q at which the global properties change drastically.

After a general introduction, the first part of the course treats several classical results, including Kesten's famous proof that the critical probability for bond percolation on the square lattice is $1/2$. Then we turn to new exciting developments which started around 2000 with work by Oded Schramm, Wendelin Werner (Fields medal 2006), Stanislav Smirnov (Fields medal 2010) and others. A key result is that at the critical value the interface between green and red regions, seen at large scale, can be described mathematically in a very nice and explicit way. Key words here are conformal invariance and Schramm-Loewner evolutions. These notions will be explained and studied during the course, and some explicit computations will be made using this machinery.

Onderwijsvorm

There will be a weekly 3-hour lecture. (Sometimes the third hour will be used for making or discussing homework exercises).

Toetsvorm

Homework assignments and oral exam

Literatuur

I will present some chapters from the book "Probability on graphs" by Geoffrey Grimmett (Cambridge University Press, 2010). Further I will use (and provide) lecture notes by myself, and some material which is freely available from the internet.

Vereiste voorkennis

Basic probability and analysis

Aanbevolen voorkennis

Some knowledge of Brownian motion and stochastic calculus, and of conformal maps, is useful in the second half of the course, but not necessary (the ingredients we use will be introduced and explained during the course).

Doelgroep

Master students Mathematics, master students Stochastics and Financial Mathematics. Also interesting for master students Theoretical Physics.

Intekenprocedure

You have to register your participation in each Mastermath course via

<http://www.mastermath.nl/registration/>

Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.

Portfolio Theory

Vakcode	X_400535 (400535)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2014-2015/zoek-vak/vak/8856>

Doelgroep

mSFM, mMath

Overige informatie

Course registration is compulsory via <https://www.sis.uva.nl>

Probability on Graphs

Vakcode	X_418151 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	500

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Scientific Writing in English

Vakcode	X_400512 ()
Periode	Periode 4
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	M. van den Hoorn
Examinator	M. van den Hoorn
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to provide the writing student with the essential linguistic means for producing English academic texts which are effective, idiomatically and stylistically appropriate and grammatically correct.

Inhoud vak

The initial focus in the course lies on the form of scientific texts in the Exact Sciences:

- Abstract (or summary)
- Introduction
- Methods
- Results
- Discussion

General course outline

Introducing the topics

- Academic and technical writing in English
- The characteristics of different kinds of scientific texts
- How scientific writing is judged and assessed
- Where do you find your information and how do you present it?
- How to avoid committing plagiarism

Who am I writing for? What do I want to say?

- Your readership
- Key parts of an academic article: title, abstract, introduction, methods, results and discussion

Writing the actual article

- Paragraph and sentence construction: how do I link paragraphs together?
- Writing simple and complex sentences. Active and passive sentences.
- Argumentation : how do I put an argument? How do I frame my own opinion?

Should I use "I" or "we"?

Writing correct English

- Use of apostrophes and colons
- Word order, verb tenses, time and tense
- Avoiding mistakes typically made by Dutch writers
- Common spelling mistakes

You will be making considerable use of peer assessment: examining fellow students' written work and giving them feedback. This method provides useful insights into how a text might be improved. The process of providing someone else with feedback on their text is something that you will find very instructive.

Onderwijsvorm

The course is focused on self-tuition. The plenary sessions concentrate on the process of writing and the product of writing. Homework is part of the course. With each topic, participants work through a phased series of exercises that usually conclude with the requirement to write a short piece of text. The instructor will append extensive written remarks to this text.

Toetsvorm

There will be no examination. However, students will receive their credits only when they have participated in all classes (presence is obligatory) and also when they have handed in the assignments satisfactorily. Students will receive a 'pass' when they have finished the course.

Literatuur

For this course you need the book *Effective Scientific Writing: an advanced learner's guide to better English* (A. Bolt & W. Bruins, ISBN 978 90 8659 6171). This book can be obtained at the VU bookstore, which is located in the VU main building. The costs are € 27,95 per book. For questions contact the Taalcentrum-VU at 020 - 598 9804.

Vereiste voorkennis

Bachelor Exact Sciences

Doelgroep

3BA, mBA, mMath, mSFM

Seminar Mathematics

Vakcode	X_405024 (405024)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. B.T. Knapik
Examinator	dr. B.T. Knapik
Docent(en)	dr. B.T. Knapik
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to learn to read papers at a research level, organise the material for the framework of a seminar talk, and practice presentation skills for such a talk. At the end of the course, the student will be able to acquire the prerequisites for reading and understanding a paper by researching the literature on his own, understand the logic of a paper, and to critically evaluate a paper. He will be able to extract and condense the material for a talk of a fixed

length.

Inhoud vak

We will read papers from a wide range of areas of mathematics. Students will have a choice from a list.

Onderwijsvorm

Seminar talks by students, individual coaching, group discussion, self study.

Toetsvorm

Seminar talk

Literatuur

Various; will be announced in the seminar

Doelgroep

mMath, mSFM

Overige informatie

This course will have three variants: 'Analysis' given by dr.O. Fabert (VU), 'Geometry' given by dr.H. Posthuma (UvA), and 'Stochastics' given by dr.B. Knapik (VU). More details at <http://www.few.vu.nl/~bkk320/semmath.html>. Course registration is compulsory. VU students register at the VU and UvA students at the UvA (<https://www.sis.uva.nl>). Note: presence at all meetings is compulsory.

Simulation Methods in Statistics

Vakcode	X_400258 (400258)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	400

Inhoud vak

The course description is available on:
<http://studiegids.uva.nl/web/uva/sgs/en/c/170.html>

Doelgroep

mMath, mSFM

Overige informatie

Course registration is compulsory via <https://www.sis.uva.nl>

Statistical Learning

Vakcode	X_418081 ()
Periode	Periode 1+2
Credits	4.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg

Examinator	prof. dr. G.J.B. van den Berg
Niveau	500

Inhoud vak

The course description is available on:

https://studiegids.leidenuniv.nl/courses/show/34709/statistical_learning_theory

Doelgroep

mSFM

Overige informatie

This course will be given at the University of Leiden. For VU and other elective students: course registration must be done on the first day of lecture directly with the lecturer.

Statistics for Networks

Vakcode	X_405110 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. M.C.M. de Gunst
Examinator	prof. dr. M.C.M. de Gunst
Docent(en)	prof. dr. M.C.M. de Gunst
Lesmethode(n)	Hoorcollege
Niveau	600

Doel vak

After this course students are acquainted with the main statistical methods and models for network analysis.

Inhoud vak

Researchers from diverse disciplines as biology, physics, sociology, economics, computer science and mathematics, are more and more involved with the collection, modeling and analysis of network data. The relational nature of network data means that statistical analysis of such data is generally more involved than the 'standard' statistical analysis, that different mathematical models and different statistical methods are needed, and that different problems need to be faced. The aim of this course is to get students acquainted with the main methods and models for network analysis. The course focuses on the mathematical aspects of statistical modeling and statistical analysis of networks; computational aspects of network analysis will not be covered. Topics that will be discussed are: descriptive statistics for networks, network sampling, network modeling, inference for networks, and modeling and prediction for processes on network graphs.

Onderwijsvorm

Lectures

Toetsvorm

Written exam and possibly presentations.

Literatuur

- Statistical Analysis of Network Data by E.D. Kolaczyk, Springer, 2010.
- Additional material will be provided during the course.

Vereiste voorkennis

An introductory probability course, like Kansrekening 1 (X_400189) plus Kansrekening 2 (X_400190), and an introductory statistics course, like Algemene Statistiek (X_400004).

Aanbevolen voorkennis

Statistical Data Analysis (X_401029)

Doelgroep

mMath, mSFM

Stochastic Integration

Vakcode	X_400470 (400470)
Periode	Periode 4+5
Credits	8.0
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	400

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/en/c/173.html>

Doelgroep

mMath, mSFM

Overige informatie

Course registration is compulsory via <https://www.sis.uva.nl>

Stochastic Optimization

Vakcode	X_400336 (400336)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. S. Bhulai
Examinator	dr. S. Bhulai
Docent(en)	dr. S. Bhulai
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The goal of the course is to discuss techniques from the field of stochastic optimization and their applications.

Inhoud vak

This course deals with the theory and algorithms for stochastic optimization with an application to controlled stochastic systems (e.g., call center management, inventory control, optimal design of communication networks). We discuss aspects of semi-Markov decision theory and their applications in certain queueing systems. In a programming assignment, students learn to implement optimization algorithms and experiment with them. Experience with and insight into the more theoretical subject is obtained through homework exercises.

Onderwijsvorm

Lectures.

Toetsvorm

Programming and written exercises, final exam.

Literatuur

Lecture notes will be posted on BlackBoard

Vereiste voorkennis

Stochastische Methoden (400391) or equivalent and a programming language.

Aanbevolen voorkennis

Stochastische Processen (X_401026) and Wachtrijmodellen (X_401061) or equivalent courses on Stochastic Processes and Queueing Theory and a programming language.

Doelgroep

mBA, mBa-D, mMath, mSFM

Stochastic Processes

Vakcode	X_400339 (400339)
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

This course is part of the joint national master programme in mathematics.

For schedules, course locations and course descriptions see <http://www.mastermath.nl>.

Registration required via <http://www.mastermath.nl>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<http://www.mastermath.nl/registration/>

Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.

Stochastic Processes for Finance

Vakcode	X_400352 (400352)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. E.N. Belitser
Examinator	dr. E.N. Belitser
Docent(en)	dr. E.N. Belitser
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

Learn basics of stochastic processes in continuous time, including the concepts of martingales and stochastic integration. Apply these concepts to price options on stocks and interest rates by the no-arbitrage principle.

Inhoud vak

Financial institutions trade in risk, and it is therefore essential to measure and control such risks. Financial instruments such as options, swaps, forwards, etc. play an important role in risk management, and to handle them one needs to be able to price them. This course gives an introduction to the mathematical tools and theory behind risk management.

A "stochastic process" is a collection of random variables, indexed by a set T . In financial applications the elements of T model time, and T is the set of natural numbers (discrete time), or an interval in the positive real line (continuous time). "Martingales" are processes whose increments over an interval in the future have zero expectation given knowledge of the past history of the process. They play an important role in financial calculus, because the price of an option (on a stock or an interest rate) can be expressed as an expectation under a so-called martingale measure. In this course we develop this theory in discrete and continuous time. Most models for financial processes in continuous time are based on a special Gaussian process, called Brownian motion. We discuss some properties of this process and introduce "stochastic integrals" with Brownian motion as the integrator. Financial processes can next be modeled as solutions to "stochastic differential equations". After developing these mathematical tools we turn to finance by applying the concepts and results to the pricing of derivative instruments. Foremost, we develop the theory of no-arbitrage pricing of derivatives, which are basic tools for risk management.

Onderwijsvorm

Lectures and exercises.

Toetsvorm

Assignments and written examination.

Literatuur

Lecture notes.

Shreve, S.E., Stochastic Calculus for Finance I: The Binomial Asset Pricing Model. Springer.

Shreve, S.E., Stochastic Calculus for Finance II: Continuous-time models. Springer.

In addition, it is useful to have the following book: Bjork, T., Arbitrage Theory in Continuous Time, third edition. Oxford University Press.

Vereiste voorkennis

Introductory probability theory and statistics, calculus.

Aanbevolen voorkennis

Introductory probability theory and statistics, calculus.

Doelgroep

mBA, mBA-D, mMath, mSFM, master Econometrics, Quantitative Finance

Overige informatie

A significant part of the course is used to introduce mathematical subjects and techniques like Brownian motion, stochastic integration and Ito calculus. In view of this, the course is NOT meant for students who already followed the master course "Stochastic Integration". On the other hand, after completing this course, students may be motivated to follow the other one (Stochastic Integration) to study the above mentioned mathematical subjects in a deeper and more rigorous way.

Survival Analysis

Vakcode	X_418152 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Examinator	dr. F. Bijma
Niveau	500

Inhoud vak

This course is taught in Leiden as part of the SFM programme.

For more information please consult

<http://www.math.vu.nl/sto/onderwijs/sfm/courses.html>

Doelgroep

mSFM

Time series

Vakcode	X_400571 (400571)
Periode	Periode 4+5

Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Docent(en)	prof. dr. A.W. van der Vaart
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

This course is part of the Joint National Master Programme in Mathematics.

For schedules, course locations and course descriptions see

<http://www.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<http://www.mastermath.nl/registration/>

Registration is mandatory and absolutely necessary for transferring your grades from Mastermath to the administration of your university.