The Master's programme in Finance is an intensive yet flexible programme which is geared towards corporate, institutional and governmental financial management, focusing on the functioning of international financial markets. After an advanced and comprehensive introduction to the various areas of finance, the student can specialise in his own field of interest, ranging from corporate financial management to quantitative asset management. After completion, the student will have developed into an academic financial specialist with a keen interest in financial economics, solid analytical skills, and a multidisciplinary outlook.

Read the full description of the programme or use the schedule below for information on the individual courses in the programme.
<table>
<thead>
<tr>
<th>Vak</th>
<th>Pagina</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Finance</td>
<td>1</td>
</tr>
<tr>
<td>M Finance - Quantitative Finance</td>
<td>1</td>
</tr>
<tr>
<td>M Finance - Quant. Fin. Electives A</td>
<td>1</td>
</tr>
<tr>
<td>M Finance - Quant. Fin. Electives B</td>
<td>1</td>
</tr>
<tr>
<td>M Finance - Quant. Fin. Obligatory</td>
<td>2</td>
</tr>
<tr>
<td>Vak: Adv Corporate Finance 4.1</td>
<td>3</td>
</tr>
<tr>
<td>Vak: Advanced Econometrics</td>
<td>3</td>
</tr>
<tr>
<td>Vak: Advanced Financial Reporting</td>
<td>5</td>
</tr>
<tr>
<td>Vak: Advanced Macroeconomics</td>
<td>6</td>
</tr>
<tr>
<td>Vak: Asset Pricing</td>
<td>7</td>
</tr>
<tr>
<td>Vak: Asymptotic Statistics</td>
<td>9</td>
</tr>
<tr>
<td>Vak: Caput Operation Research</td>
<td>9</td>
</tr>
<tr>
<td>Vak: Corporate Governance, Risk Management and Control</td>
<td>10</td>
</tr>
<tr>
<td>Vak: Corporate Law</td>
<td>11</td>
</tr>
<tr>
<td>Vak: Data Mining Techniques</td>
<td>13</td>
</tr>
<tr>
<td>Vak: Derivatives</td>
<td>14</td>
</tr>
<tr>
<td>Vak: Empirical Finance</td>
<td>15</td>
</tr>
<tr>
<td>Vak: Empirical Research in Accounting</td>
<td>17</td>
</tr>
<tr>
<td>Vak: Evolutionary Computing</td>
<td>18</td>
</tr>
<tr>
<td>Vak: Financial Markets and Institutions</td>
<td>19</td>
</tr>
<tr>
<td>Vak: Financial Risk Management (Quantitative Finance)</td>
<td>20</td>
</tr>
<tr>
<td>Vak: Globalization, Growth and Development</td>
<td>21</td>
</tr>
<tr>
<td>Vak: Grondslagen waarschijnlijkheidsrekening</td>
<td>22</td>
</tr>
<tr>
<td>Vak: Mathematical System Theory</td>
<td>23</td>
</tr>
<tr>
<td>Vak: Private Equity and Behavioral Corporate Finance</td>
<td>23</td>
</tr>
<tr>
<td>Vak: Real Estate Management</td>
<td>24</td>
</tr>
<tr>
<td>Vak: Research Project Finance</td>
<td>26</td>
</tr>
<tr>
<td>Vak: Simulation and Stochastic Systems</td>
<td>27</td>
</tr>
<tr>
<td>Vak: Stochastic Optimization</td>
<td>28</td>
</tr>
<tr>
<td>Vak: Stochastic Processes for Finance</td>
<td>29</td>
</tr>
<tr>
<td>Vak: Strategic and Cooperative Decision Making</td>
<td>30</td>
</tr>
<tr>
<td>Vak: Thesis</td>
<td>31</td>
</tr>
<tr>
<td>Vak: Thesis</td>
<td>31</td>
</tr>
<tr>
<td>Vak: Time Series Econometrics</td>
<td>32</td>
</tr>
</tbody>
</table>
M Finance

Vakken:

<table>
<thead>
<tr>
<th>Naam</th>
<th>Periode</th>
<th>Credits</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adv Corporate Finance 4.1</td>
<td>Periode 1</td>
<td>6.0</td>
<td>E_FIN_ACF</td>
</tr>
<tr>
<td>Asset Pricing</td>
<td>Period 1</td>
<td>6.0</td>
<td>E_FIN_AP</td>
</tr>
<tr>
<td>Derivatives</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_DER</td>
</tr>
<tr>
<td>Empirical Finance</td>
<td>Period 2</td>
<td>6.0</td>
<td>E_FIN_EF</td>
</tr>
<tr>
<td>Financial Markets and Institutions</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_FMI</td>
</tr>
<tr>
<td>Financial Risk Management (Quantitative Finance)</td>
<td>Period 5</td>
<td>6.0</td>
<td>E_FIN_QFRM</td>
</tr>
<tr>
<td>Private Equity and Behavioral Corporate Finance</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_PEBCF</td>
</tr>
<tr>
<td>Real Estate Management</td>
<td>Period 5</td>
<td>6.0</td>
<td>E_BA_REM</td>
</tr>
<tr>
<td>Research Project Finance</td>
<td>Period 3</td>
<td>6.0</td>
<td>E_FIN_RPFIN</td>
</tr>
<tr>
<td>Thesis</td>
<td>Ac. Jaar (september)</td>
<td>18.0</td>
<td>E_FIN_THS</td>
</tr>
</tbody>
</table>

**M Finance - Quantitative Finance**

Opleidingsdelen:

- M Finance - Quant. Fin. Electives A
- M Finance - Quant. Fin. Electives B
- M Finance - Quant. Fin. Obligatory

**M Finance - Quant. Fin. Electives A**

Vakken:

<table>
<thead>
<tr>
<th>Naam</th>
<th>Periode</th>
<th>Credits</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adv Corporate Finance 4.1</td>
<td>Periode 1</td>
<td>6.0</td>
<td>E_FIN_ACF</td>
</tr>
<tr>
<td>Financial Markets and Institutions</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_FMI</td>
</tr>
<tr>
<td>Private Equity and Behavioral Corporate Finance</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_PEBCF</td>
</tr>
<tr>
<td>Real Estate Management</td>
<td>Period 5</td>
<td>6.0</td>
<td>E_BA_REM</td>
</tr>
</tbody>
</table>

**M Finance - Quant. Fin. Electives B**
## Vakken:

<table>
<thead>
<tr>
<th>Naam</th>
<th>Periode</th>
<th>Credits</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Financial Reporting</td>
<td>Period 1</td>
<td>6.0</td>
<td>E_ACC_AFR</td>
</tr>
<tr>
<td>Advanced Macroeconomics</td>
<td>Period 2</td>
<td>6.0</td>
<td>E_EC_AMAEC</td>
</tr>
<tr>
<td>Asymptotic Statistics</td>
<td>Period 1+2</td>
<td>8.0</td>
<td>X_400323</td>
</tr>
<tr>
<td>Caput Operation Research</td>
<td>Period 1</td>
<td>6.0</td>
<td>E_EORM_COR</td>
</tr>
<tr>
<td>Corporate Governance, Risk Management and Control</td>
<td>Period 5</td>
<td>6.0</td>
<td>E_ACC_CGRMC</td>
</tr>
<tr>
<td>Corporate Law</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_ACC_CL</td>
</tr>
<tr>
<td>Data Mining Techniques</td>
<td>Period 5</td>
<td>6.0</td>
<td>X_400108</td>
</tr>
<tr>
<td>Empirical Research in Accounting</td>
<td>Period 1</td>
<td>6.0</td>
<td>E_ACC_ERA</td>
</tr>
<tr>
<td>Evolutionary Computing</td>
<td>Period 1</td>
<td>6.0</td>
<td>X_400111</td>
</tr>
<tr>
<td>Globalization, Growth and Development</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_EC_GGD</td>
</tr>
<tr>
<td>Grondslagen waarschijnlijkheidsrekening</td>
<td>Periode 4+5</td>
<td>6.0</td>
<td>X_400027</td>
</tr>
<tr>
<td>Mathematical System Theory</td>
<td>Period 4+5</td>
<td>6.0</td>
<td>X_400180</td>
</tr>
<tr>
<td>Simulation and Stochastic Systems</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_EORM_SSS</td>
</tr>
<tr>
<td>Stochastic Optimization</td>
<td>Periode 1+2</td>
<td>6.0</td>
<td>X_400336</td>
</tr>
<tr>
<td>Strategic and Cooperative Decision Making</td>
<td>Period 2</td>
<td>6.0</td>
<td>E_EORM_SCDM</td>
</tr>
<tr>
<td>Thesis</td>
<td>Ac. Jaar (september)</td>
<td>24.0</td>
<td>E_FIN_QFTHSS</td>
</tr>
</tbody>
</table>

## M Finance - Quant. Fin. Obligatory

<table>
<thead>
<tr>
<th>Naam</th>
<th>Periode</th>
<th>Credits</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Econometrics</td>
<td>Period 1+2</td>
<td>6.0</td>
<td>E_EORM_AECTR</td>
</tr>
<tr>
<td>Asset Pricing</td>
<td>Period 1</td>
<td>6.0</td>
<td>E_FIN_AP</td>
</tr>
<tr>
<td>Derivatives</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_DER</td>
</tr>
<tr>
<td>Financial Risk Management (Quantitative Finance)</td>
<td>Period 5</td>
<td>6.0</td>
<td>E_FIN_QFRM</td>
</tr>
<tr>
<td>Private Equity and Behavioral Corporate Finance</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_FIN_PEBCF</td>
</tr>
<tr>
<td>Research Project Finance</td>
<td>Period 3</td>
<td>6.0</td>
<td>E_FIN_RPFIN</td>
</tr>
<tr>
<td>Stochastic Processes for Finance</td>
<td>Periode 1+2</td>
<td>6.0</td>
<td>X_400352</td>
</tr>
<tr>
<td>Thesis</td>
<td>Ac. Jaar (september)</td>
<td>24.0</td>
<td>E_FIN_QFTHSS</td>
</tr>
<tr>
<td>Time Series Econometrics</td>
<td>Period 4</td>
<td>6.0</td>
<td>E_EORM_TSE</td>
</tr>
</tbody>
</table>
Adv Corporate Finance 4.1

Vakcode E_FIN_ACF ()
Periode Periode 1
Credits 6.0
Voertaal Engels
Faculteit Fac. der Economische Wet. en Bedrijfsk.
Coördinator prof. dr. ir. H.A. Rijken
Docent(en) prof. dr. ir. H.A. Rijken
Lesmethode(n) Hoorcollege, Werkgroep

Doel vak
Achieve advanced knowledge in the theory and practice of corporate finance. The main objective is to fully understand theoretical concepts (their strengths and limitations) and to use these theoretical frameworks to solve in an effective way practical issues in corporate finance. After following this course, you:

- understand basic Corporate Finance concepts, including their strengths and limitations
- have the quantitative skills to apply these basic concepts
- understand the interrelationship between various concepts and link them in a general framework
- are able to apply this framework in real life cases

Advanced Econometrics

Course code E_EORM_AECTR (64412001)
Period Period 1+2
Credits 6.0
Language of tuition English
Faculteit Fac. der Economische Wet. en Bedrijfsk.
Coordinator prof. dr. S.J. Koopman
Teaching staff prof. dr. S.J. Koopman
Teaching method(s) Lecture, Study Group

Course objective
To gain a profound and detailed understanding of advanced econometric theory and methods. By the end of this course, participants will:

have detailed knowledge of
- principles of econometric theory and practical methods at the graduate level
- advanced statistical concepts used in econometric theory and their application in econometric modelling

know how to
- estimate and test both cross-section and time-series models
- evaluate econometric procedures by means of simulation experiments
- solve theoretical econometric exercises
understand
- the interplay between econometric techniques and modelling assumptions
- the proofs of asymptotic properties of important estimators and test statistics
have gained experience in
- solving an econometric research questions as part of a group
- presenting the solution to the class
- discussing other groups’ presentations

Course content
Advanced Econometrics I

The three main topics of this course are:

- Nonlinear regression and generalised least squares,
- Instrumental variable estimation,
- Generalized methods of moments.

This course recaps and extends undergraduate knowledge of econometric theory and methods at the graduate level, focussing on a number of selected methods and models. Estimators for both linear and non-linear models will be examined, including least-squares, and generalized methods of moments. Point estimation as well as confidence interval estimation will be considered. For different estimators and test statistics the question is addressed of how exact, bootstrap or asymptotic inference can be conducted.

Note: the econometrics programme is currently under revision. Some topics may change. Please consult the latest version of the online study guide.

Advanced Econometrics II

The three main topics in Advanced Econometrics II are maximum likelihood estimation, multivariate regression analysis and multivariate time series analysis.

The course recaps and extends undergraduate knowledge of econometric theory and methods at the graduate level, focussing on a number of selected methods and models. Estimators for both linear and non-linear models will be examined. Testing procedures that will take centre stage include Lagrange multiplier test as well as conditional moment tests. For all estimators and test statistics the question is addressed of how exact, bootstrap or asymptotic inference can be conducted.

Note: the econometrics programme is currently under revision. Some topics may change. Please consult the latest version of the online study guide.

Form of tuition
lecture and tutorial

Some lectures can be used for students to give presentations on selected topics.

Type of assessment
Written examination.
There are two separate written exams for Advanced Econometrics I (period 1) and for Advanced Econometrics II (period 2). Minimum required result for Advanced Econometrics I is 5.5 and for Advanced Econometrics II is 5.0. Total grade for the combined 6 ECTS version is the average of the two grades and must be at least 5.5 for a pass. The two partial grades are measured in one decimal point; the total grade is the rounded average of the two grades.

Starting September 2010, the first part can be taken as a single elective course for 3 ECTS.

Note: the econometrics programme is under revision. The examination format may change slightly. Please consult the latest version of the online study guide.

**Course reading**

Advanced Econometrics I and II:

Advanced Econometrics II:

Other references:

Current URL: [www.ssc.wisc.edu/~bhansen/econometrics/](http://www.ssc.wisc.edu/~bhansen/econometrics/)

**Advanced Financial Reporting**

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_ACC_AFR (60412050)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 1</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>prof. dr. C. Camfferman RA</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture, Study Group</td>
</tr>
</tbody>
</table>

**Course objective**

An understanding of International Financial Reporting Standards (IFRS) is essential for anyone who needs to work with the financial statements of major enterprises, or data drawn from these financial statements. This course provides students who already have a good grounding in financial accounting with a level of general understanding of IFRS that will make them informed users of financial statements, or that will prepare them for the more advanced specialist training required of preparers and auditors of financial statements. After following this course, you will:

- understand the general structure of current IFRS, the main concepts underling all standards and the key features of selected standards
- have learned to view IFRS as an evolving set of standards, and to evaluate existing or proposed standards in terms of their consistency with other standards or with underlying general concepts
- be able to conceptualize a given accounting problem in terms that allow you to identify the appropriate treatment under current IFRS
- be able to explain the meaning of specific numbers and other information in actual company financial statements by reference to the underlying standards.

**Course content**
Apart from a brief introduction to the work and status of the International Accounting Standards Board, the course consists of a review of a substantial part of the extant International Financial Reporting Standards. The course concentrates on issues of (de) recognition and measurement, not on disclosure and presentation requirements. Topics covered include:

- The IASBs Conceptual Framework, the asset/liability approach, fair value, and the IASBs evolving views on performance measurement
- Tangible and intangible assets and impairment
- Revenue recognition and accounting for income taxes
- Share-based payments and accounting for retirement benefits
- Business combinations and group accounting (including currency translation)
- Financial instruments.

**Form of tuition**
Lectures and discussion classes. Students are expected to study some standards, or parts of standards by themselves. More complex topics or topics that will be less familiar will be the subject of lectures and/or assignments.

**Type of assessment**
Written interim examination with the option to earn a small bonus by preparing assignments on an individual basis.

**Course reading**

**Entry requirements**
Financial Accounting 3.1., or equivalent.

**Recommended background knowledge**
A knowledge of financial accounting equivalent to Financial Accounting 3.1 will be assumed. Detailed information about assumed entry-level knowledge is provided in the course manual.

### Advanced Macroeconomics

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_EC_AMAEC (60422010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 2</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>prof. dr. E.J. Bartelsman</td>
</tr>
</tbody>
</table>
Course objective
The students will be able to actively read current literature and embark on their own research projects using the knowledge gained about the analytical, mathematical, and statistical tools of modern macroeconomics. The tools include dynamic optimization, signal extraction, Nash bargaining, and the basic building blocks of DSGE models.

Course content
This course provides coverage at an advanced level of the building blocks of macroeconomics. Models of economic growth will be built up from inter-temporal optimisation decisions of firms and households. The basic model will be extended to take into account the effects on growth of investment in knowledge (R&D, education). Next, the course will present the tools of Real Business Cycle analysis and recent applications. Finally, the course will present the current state of work in New Keynesian economics and its implications for cyclical fluctuations, the functioning of the labor market and the conduct of monetary policy.

Form of tuition
lecture

Type of assessment
written interim examination plus problem sets.

Course reading
Romer, David Advanced Macro Economics. 3rd edition, McGraw Hill.

Asset Pricing

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_FIN_AP ()</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 1</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. F. Brevik</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>dr. F. Brevik</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture, Study Group</td>
</tr>
</tbody>
</table>

Course objective
This course aims to deepen your knowledge in the field of asset pricing and asset allocation. After completion of the course, you should:
- Have a thorough understanding of how security prices are determined in financial markets, including equity and fixed income.
- Understand and be able to apply optimal asset allocations for both individual and institutional investors.
- Acquire an academic and critical attitude towards competing technique in investment problems.
- Be comfortable with doing advanced analyses in Software such as
Course content
Starting from basic (undergraduate) Investments knowledge, this course centers around the issues of asset pricing and asset allocation. In the first week we revisit the well known mean-variance framework and derive the standard CAPM in this set-up. In the second week we explore empirical deviations from the CAPM and discuss how these can be exploited. Here we also touch upon some issues related to behavioral finance. In the third week we study dynamic optimization. Dynamic programming is introduced by the example of pricing American options. We then use the same technique to solve for the optimal dynamic asset-allocation policy when investment opportunities are constant. In the forth week, we study variations in expected returns and link these to fundamental ratios. In the fifth week we explore how investors should exploit variations in expected returns and introduce the I-CAPM. Consumption based asset pricing is covered in the last week.

Form of tuition
Each of the 6 weeks of the course feature 4 hours of formal lectures and 2 hours of recitations. During recitations we will go through exercises to the topics covered in that week. The exercises are at the end of the relevant chapter of the lecture notes. Draft solutions will be posted on Blackboard after the recitations. In addition there are 3 group work assignments. The focus of these assignments is to apply the theoretical knowledge from class to real world problems using Excel or other software. In addition to gaining a deeper understanding of the topics in the course, the assignments will train you in quantitative computer skills you will need later in their career and prepare you for similar assignments in other courses and your thesis. For each assignment, you work in groups of three students. Assignments will be due at the end of the weeks 1, 3, and 5 of the term.

Type of assessment
To pass this course, you need a minimum final grade of 6.0 and a minimum grade on the written exam of 5.0. If you score less than 5.0 on the written exam, your final grade is equal to that grade. If you score 5.0 or higher, the final grade is given by:

Final grade = 0.7*(Written exam grade) + 0.3*(Average assignment grade)

Course reading
- Lecture notes.
- Selected research articles and news clippings.
- [For background reading] Boadie, Kane, Markus: Investments (2008; MacGraw-Hill)

Entry requirements
You should be familiar with investments at the level of Bodie, Kane & Marcus, Investments. Undergraduate level knowledge of statistics and mathematics is also required (e.g., Berenson, Levine, Krehbiel: Basic Business Statistics; and Sydsaeter and Hammond (2006; Prentice Hall): Essential Mathematics for Economic Analysis, Sydsaeter, Hammond, Seierstad, and Strom (2005; Prentice Hall): Further mathematics for Economic Analysis (chapters 4 and 11)).

Recommended background knowledge
You are expected to be very versatile in a relevant software package, such as Microsoft Excel (or any other similarly advance package) and use
it to perform estimation and optimization. Core texts here are Benninga, Financial Modeling, or (more advanced) Jackson and Staunton, Advanced modeling in Finance using excel and VBA.

Please note that the department will offer an advanced Excel course for Finance from August 29-September 2. Unless you already know how to perform optimizations and estimation in Excel and program VBA you should take this course.

Remarks
This course may have an in-depth empirical follow-up by choosing an appropriate Investments team-research-project during the January / February period.

Asymptotic Statistics

<table>
<thead>
<tr>
<th>Vakcode</th>
<th>X_400323 (400323)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periode</td>
<td>Periode 1+2</td>
</tr>
<tr>
<td>Credits</td>
<td>8.0</td>
</tr>
<tr>
<td>Voertaal</td>
<td>Engels</td>
</tr>
<tr>
<td>Faculteit</td>
<td>Faculteit der Exacte Wetenschappen</td>
</tr>
<tr>
<td>Coördinator</td>
<td>prof. dr. G.J.B. van den Berg</td>
</tr>
</tbody>
</table>

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](http://www.mastermath.nl). Registration required via [http://www.mastermath.nl](http://www.mastermath.nl).

Caput Operation Research

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_EORM_COR ()</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 1</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. ir. R.A. Sitters</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>prof. dr. L. Stougie</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture</td>
</tr>
</tbody>
</table>

Course objective
In this course we will learn how to develop efficient algorithms for solving fundamental optimization problems with applications in routing, network design and scheduling. The objectives of the course are:
- get to know models to capture different types of optimization problems (offline, online, distributed)
- learn basic and advanced techniques to solve such optimization problems (primal-dual schema, randomized rounding, iterative rounding, potential functions, local search, etc.)
- use these techniques to design efficient algorithms
- study the computational complexity of optimization problems
Course content
Topics that will (probably) be covered in the course are:
- Steiner network, facility location, scheduling problems, network routing, congestion games, network design
- online algorithms, randomized algorithms, approximation algorithms, local search algorithms
- computational complexity and hardness of approximation

Form of tuition
Lectures and tutorials; take-home assignments will be discussed bi-weekly

Type of assessment
written exam

Course reading
The material to be covered in class is based on the following books:

Entry requirements
none

Recommended background knowledge
basic knowledge on algorithms, computational complexity and combinatorial optimization is advantageous (see, e.g., material covered in the bachelor course Combinatorial Optimization)

Corporate Governance, Risk Management and Control

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_ACC_CGRMC (60452000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 5</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>prof. dr. O.C. van Leeuwen</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>drs. J.G.I. van den Belt RA, drs. J.H.C.A. van der Wijst RA</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture, Study Group</td>
</tr>
</tbody>
</table>

Course objective
It is usually in the interest of everybody that organizations continue to exist as an entity. Given that statement, we can wonder why we have seen so many cases of failing corporate governance over the last decade. Greed, accounting fraud and plain mismanagement have led to the dismantlement of several large corporations, and with that the disappearance of significant amounts of shareholders' money, pension money, jobs, and the trust in our economic system.
As many of the shareholders are also voters, many countries have as a result strengthened their legislation on corporate governance, stressing in particular management's responsibility to have in place an adequate
internal control system for financial reporting. This focus on being in control has led to massive investments in control systems and procedures.

One might wonder if this focus on internal control over financial reporting needs to be brought back in balance with the basics of entrepreneurship, where corporate governance is seen as the strategic response to taking risk. The challenge for corporations in the coming years is to continue to take risks - leading to innovation, growth and prosperity - and manage them in such a way that internal control, especially over financial reporting, is never weakened. Information systems play a key role in reaching this goal.

After attending this course, students should:
- Understand the concepts Corporate Governance, Internal Control and Risk Management and their relationship;
- Understand the roles and responsibilities of the various stakeholders of a private or public organization;
- Have insight in the content of the most important Corporate Governance codes;
- Be able to form an opinion on real life cases of alleged mismanagement and fraud;
- Be able to communicate about these cases and indicate what improvements in risk management and information systems are needed to solve the problems at hand.

Course content
Lectures: The theory will be discussed during the lectures. Students are encouraged to ask questions and participate actively to discuss the topics.

Seminars: Cases will be discussed during the seminars. The students need to prepare the cases. Part of this preparation is the collection of relevant newspaper articles and other literature (such as scientific articles, annual reports, books, internet) relevant to the topic. The preparation of cases is done in groups. Each group is required to submit its presentation to Blackboard no later than the Wednesday before the respective seminar. The presentations must be presented in the seminar. All sources used have to be mentioned in the presentation. The groups will be formed during the first seminar. During each Friday seminar, several groups will give their presentation. The presentations and participation during the lectures and the seminars are components of the overall grade for this course.

Type of assessment
- Written exam 60%;
- Cases and participation 40%.

Course reading
- Book: Corporate Governance, Risk Management and Internal Control: The key role of information systems, R.J. Streng, Bertius Publishers, 2010
- A syllabus containing a series of articles and cases
- It is possible that other literature has to be studied during the lectures.

Entry requirements
Knowledge of the course Accounting Information Systems is assumed.

Recommended background knowledge
Knowledge of the course Accounting Information Systems is assumed.

Corporate Law
Course objective
Corporate Law is taught in Dutch. International exchange students attend an English version of this course. See below at remarks. The Dutch-taught course deals with the key issues of Dutch company law, mainly concentrating on corporations (BV's and NV's). The objective of this course is to deepen the participants' knowledge and insight of how Dutch corporations work and problems related to Dutch corporations.

After following this course, you:
- have knowledge and insight of how Dutch corporations are organized
- have insight of problems related to Dutch corporations
- have knowledge of the 12 subjects listed below
- have worked with and discussed (real life) cases concerning Dutch corporations
- are informed on current affairs of the NV and BV, including recent case law of the Dutch Supreme Court

Course content
The course is organized around 12 subjects:
- Introduction and basics of Dutch company law
- European company law
  – Concern law
- Internal governance of companies
- Corporate governance
- Capital protection
- Liability of (supervisory) directors and shareholders
- Listed and non-listed companies
- Protective devices
- Mergers and acquisitions
- Law regarding annual accounts
- Disputes

Form of tuition
Lectures, study group

Type of assessment
Written examination and one assignment. The written exam accounts for 80 percent of the final mark and the assignment accounts for 20 percent of the final mark.

Course reading
- Syllabus J.E. Brink-van der Meer
- Documents placed on Blackboard
Remarks
International students follow an English version of this course instead. Please contact Annelies Brink at jebrink@feweb.vu.nl for further details regarding lectures and literature. The Dutch-taught version of Corporate law is mandatory for all Dutch speaking full-time students and all part-time students from the MSc Programme Accounting and Control. The Dutch-taught course is recommended to students from other Master programs who aspire to a career in which elements of law play an important role (for instance corporate finance and banking).

Data Mining Techniques

<table>
<thead>
<tr>
<th>Course code</th>
<th>X_400108 (400108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 5</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Faculteit der Exacte Wetenschappen</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. Z. Szlavik</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>dr. Z. Szlavik</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture</td>
</tr>
</tbody>
</table>

Course objective
The aim of the course is that students acquire data mining knowledge and skills that they can apply in a business environment. How the aims are to be achieved: Students will acquire knowledge and skills mainly through the following: an overview of the most common data mining algorithms and techniques (in lectures), a survey of typical and interesting data mining applications, and practical assignments to gain "hands on" experience. The application of skills in a business environment will be simulated through various assignments of the course.

Course content
The course will provide a survey of basic data mining techniques and their applications for solving real life problems. After a general introduction to Data Mining we will discuss some "classical" algorithms like Naive Bayes, Decision Trees, Association Rules, etc., and some recently discovered methods such as boosting, Support Vector Machines, and co-learning. A number of successful applications of data mining will also be discussed: marketing, fraud detection, text and Web mining, possibly bioinformatics. In addition to lectures, there will be an extensive practical part, where students will experiment with various data mining algorithms and data sets. The grade for the course will be based on these practical assignments (i.e., there will be no final examination).

Form of tuition
Lectures and compulsory practical work. Lectures are planned to be interactive: there will be small questions, one-minute discussions, following an algorithm on paper, looking for patterns in a dataset about you (!), filling in missing pieces in a table, coming up with a number of creative solutions to a small problem, etc.
Type of assessment
Practical assignments (i.e. there is no exam). There will be three assignments, some (parts) of these will be done individually, some in groups of two. There is a possibility to get a grade without doing these assignments: one (!) group can be selected (based on interviews conducted by the lecturer) to do a real research project instead (which - be warned - will most likely to involve more work, but it can also be more rewarding).

Course reading

Entry requirements
Kansrekening en Statistiek of Algemene Statistiek (knowledge of statistics and probabilities) or equivalent. Recommended: Machine Learning.

Target group
mBMI, mCS, mAI, mBio

Derivatives

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_FIN_DER (60442060)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 4</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. M. Boes</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>dr. M. Boes</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture, Study Group</td>
</tr>
</tbody>
</table>

Course objective
By the end of the course students should have a sound understanding of the pricing, practical applicability, operational complexity, and risks of several linear and non-linear derivatives.

Course content
In today’s financial world, the role of derivatives gets increasingly important. Banks use them to manage their balance sheet and trading activities, corporate treasuries need them for mitigation of international trade risk, insurance companies actively apply them strategically to hedge long term interest rate exposures and pension funds use derivatives for protection against a shortfall in funding level. The last decade, derivatives trading worldwide has exploded to unprecedented levels. A thorough understanding of all aspects with respect to derivatives is indispensable for anyone pursuing a job in finance.

This understanding can be achieved by:
- knowing the different types of derivatives and understanding their possible applications
- understanding and applying arbitrage free valuation techniques
- understanding the product providers on the one hand and end users and
the most relevant applications on the other hand
- applying these products in economic simulations

In this course the following subjects will therefore be treated:
- why derivatives
- forwards, futures, total return swaps
- interest rates, forward rate agreements, floating rate bonds
- nominal interest rate swaps, asset swaps
- option markets, option pricing
- option returns and the CAPM
- stochastic volatility, volatility trading, volatility risk premium
- inflation derivatives, swaptions, corporate bonds, CDS

For each of the topics also practical considerations will be discussed.

There will be one guest lecture from someone working in the industry.

Form of tuition
The course spans a period of six weeks. Each week, there are four
sessions of 45 minutes (dates and times to be announced), in which
teaching and exercises are mixed. Students are required to hand in two
cases. The cases are mandatory and make up for 30 percent of the total
result. The remaining 70 percent can be achieved via the written exam.

Type of assessment
1. written exam: 70 percent
2. case studies: 30 percent

Course reading
- John Hull: Options, Futures and Other Derivatives, 7th Edition
- Relevant papers on volatility trading and inflation derivatives

Entry requirements
Students entering this course should be familiar with the basic
corporate finance principles and techniques (e. g. Brealey & Myers,
Principles of corporate finance. 2002) and investment management
concepts (e. g. Bodie, Kane & Marcus, Investments. 1996).

For an efficient way of solving the cases, experience with Excel/VBA (or
any another programming language) is required.

Empirical Finance

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_FIN_EF (60442070)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 2</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfs.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>prof. dr. A. Lucas</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>dr. R.G.W. Kraussl, prof. dr. A. Lucas</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture, College case</td>
</tr>
</tbody>
</table>

Course objective
Upon successful completion, students should
- have a thorough understanding of empirical research methodology in
finance (including (non-linear) regression, endogeneity, instrumental variables, time series, event studies, volatility models);
- be able to select the appropriate methodology for an empirical research question;
- be able to set up an empirical analysis and gather and clean the data for this analysis;
- be able to use a statistical package to obtain empirical results;
- be able to critically interpret and assess the results obtained;
- be able to report the results concisely.
In this way students should be well prepared for the team research project in Block 3, and for the academic thesis in Block 5/6.

Course content
This course offers students the opportunity to study advanced empirical research methods in finance. The objective is to increase the students' ability to understand and to apply empirical methods in finance. The course represents an integration of theory, methods and examples. We use EViews as our standard software, but students are free to choose any package or programming language they like. The aim of the course is to enable students to undertake their own quantitative research projects in practice.

The course concentrates on the following issues: regression model, endogeneity and instrumental variables, time series models, tests for information efficiency, market microstructure, credit risk, event study analysis, portfolio valuation, fixed income, volatility models (GARCH), switching models.

Form of tuition
There are two lecture sessions each week for six weeks. There are Q&A sessions and case discussion sessions two hours each week. Teaching consists of lectures and both classroom discussions and computer exercises. Students are expected to actively participate in all classroom discussions. The purpose of the compulsory computer exercises is to give students the practical skills for solving empirical finance problems.

Type of assessment
There is a final written exam (70 percent). There are a number of cases during the course (30 percent).

Course reading
Slides and lecture notes.
Relevant academic papers (to be indicated at the start of the course).

Entry requirements
Students should have a sound knowledge of introductory econometrics and statistics at the bachelor level and be familiar with key concepts of corporate finance, investments and financial markets.

Recommended background knowledge
Core courses Advanced Corporate Finance (4.1) and Asset Pricing (4.1).

Further, the entry level texts of the MSc Finance programme:
Course objective
The objective of this course is to explore and provide an understanding of the different research methods employed in empirical accounting research. At the end of the course the student should have a strong enough understanding of the different methods discussed to be able to interpret and critically evaluate empirical accounting studies, and to be able to use these methods to conduct an empirical accounting study him/herself. More specifically, after following this course, the student:
- will have a better understanding of the main research methods used in empirical accounting research, and their strengths and weaknesses;
- will be better able to interpret and critically evaluate empirical accounting research; and
- will be better able to him/herself conduct empirical accounting research.

Course content
Empirical research in accounting relates to financial accounting, management accounting and auditing. In this accounting research a wide variety of research methods is used. This variety stems from the diversity of theories used, topics and questions studied and the research methods researchers have at hand. Some general patterns can be observed though. For instance, while financial accounting research often builds on publicly available data archives, management accounting research often builds on company specific data. This difference partly stems from the difference in questions these domains of accounting are interested in, but also to the availability of data. The course starts with an overview of the types of questions studied in empirical financial and managerial accounting research and the types of methods and data used for analysis. After this overview the remainder of the course is structured following the research methods most frequently employed in accounting research. Each method will be studied in depth in relation to the type of question it is suitable for. In this analysis, the focus will lie on both the use of the method and the (accounting) domain it is being used in.

Form of tuition
Lectures
Type of assessment
Written interim examination
Students' evaluation will be based on two parts:

1) a written exam at the end of the course; and
2) an assignment in the form of a (limited) empirical study.

Course reading
To be announced

Evolutionary Computing

<table>
<thead>
<tr>
<th>Course code</th>
<th>X. 400111 (400111)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 1</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Faculteit der Exacte Wetenschappen</td>
</tr>
<tr>
<td>Coordinator</td>
<td>prof. dr. A.E. Eiben</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>prof. dr. A.E. Eiben</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture</td>
</tr>
</tbody>
</table>

Course objective
To learn about computational methods based on Darwinian principles of evolution. To illustrate the usage of such methods as problem solvers and as simulation, respectively modelling tools. To gain hands-on experience in performing experiments.

Course content
The course is treating various algorithms based on the Darwinian evolution theory. Driven by natural selection (survival of the fittest), an evolution process is being emulated and solutions for a given problem are being "bred". During this course all "dialects" within evolutionary computing are treated (genetic algorithms, evolutiestrategieën, evolutionary programming, genetic programming, and classifier systems). Applications in optimisation, constraint handling and machine learning are discussed. Specific subjects handled include: various genetic structures (representations), selection techniques, sexual and asexual genetic operators, (self-)adaptivity. If time permits, subjects in Artificial Life and Artificial Societies, and Evolutionary Art will be handled. Hands-on-experience is gained by a compulsory programming assignment.

Form of tuition
Oral lectures and compulsory programming assignment.

Type of assessment
Written exam and programming assignment (weighted average).

Course reading

Target group
Financial Markets and Institutions

Course objective
Well-functioning financial markets are key to the well-being of the economy as financial institutions act as intermediaries to channel funds across the economy. However, market efficiency should be seen as the exception rather than the norm. Adequate regulation and supervision are necessary for an efficient allocation of funds and proper pricing of risk. International coordination is called for because of the interlinkages between global financial markets. After the course students should be able to apply theoretical and analytical concepts to topical financial market issues and to formulate business and policy oriented recommendations for financial institutions and regulators, such as: the issues that central bankers face in maintaining financial stability; how financial institutions and policymakers should cope with systemic risk; how international institutions as the IMF and the BIS can help prevent and resolve financial crises; the role of credit rating agencies and hedge funds in financial markets.

Course content
The course takes as a starting point the financial crisis of 2008, which unlike most earlier financial crises originated in advanced countries and had a global impact. There is not a single factor that caused the crisis and we can learn from the many failings in the financial system that became apparent. For most of these failings, theroretical notions, such as agency problems and the pro-cyclical effects of risk-based regulation, were apparent before the crisis. Other theoretical notions have been developed more recently. The challenge is how to turn these theoretical concepts into practical regulations and changed behaviour. Therefore, we will analyze the challenges central bankers and supervisors face in the area of financial stability and monetary policy. We will examine proposals to improve the risk management of banks. We will finish the course with the challenges for the euro area in the face of the problems in the periphery – Greece, Ireland and Portugal. We have two guest lecturers from the central bank and a commercial bank.

Form of tuition
Lecture
tutorial

Students will be required to prepare the lectures by studying the literature in advance and are expected to be able to present brief summaries and issues for discussion in class.
Type of assessment
assignment
written interim examination

Entry requirements
Students should have followed a bachelor course in Money and Banking.

Recommended background knowledge
The following book indicates the level of knowledge which is required: -

Financial Risk Management (Quantitative Finance)

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_FIN_QFRM (60422110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 5</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. S.A. Borovkova</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>dr. S.A. Borovkova</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture</td>
</tr>
</tbody>
</table>

Course objective
Deep understanding and ability to implement modern quantitative risk measurement and management techniques.

Course content
The lecturers are Dr. S. Borovkova, an expert on derivatives, risk management and energy markets, and Dr. A. van Haastrecht, Senior Risk Manager of Aegon. In this course we will examine various types of financial risks facing corporations and financial institutions, such as market, credit and operational risks. The course will encompass both theoretical and applied aspects of risk management. This course will give you a solid fundamental for measurement and management of financial risks, knowledge of newest quantitative methods and the ability to apply your knowledge in corporate environment. The lectures are complemented by participants’ presentations about recent financial disasters (Amaranth, Société General, LTCM, Barings and others), credit crisis and by practical assignments designed to maximally match actual risk management applications in banking environment. For this course you need a strong quantitative focus and affiliation with statistics and probability as well as (some) affiliation with finance, or an intention to learn necessary concepts and vocabulary. For this course you need a strong quantitative focus and affiliation with statistics and probability as well as (some) affiliation with finance, or an intention to learn necessary concepts and vocabulary.

Form of tuition
Lectures (6 hours per week)

Type of assessment
2 cases (assignments) and written exam
Course reading
Embrechts, Frey and McNeal “Quantitative Risk Management”

Recommended background knowledge
Introductory statistics and probability, implementation skills (Excel, Matlab, Eviews or any other computer package)

Globalization, Growth and Development

Course objective
Aim of the course is to study aspects of globalization, growth and development that are fruitfully studied from the perspective of the economics discipline. After following the course the student will

- know the basic facts concerning the topics discussed in the course
- have a thorough understanding of these topics, in particular their economic dimension
- have learnt various empirical research techniques that can be applied within this field of economics
- be able to present and discuss current journal articles and book chapters on globalization

Course content
Globalization poses both challenges and offers opportunities to rich and poor countries. The course focuses on a number of themes that have been central in the academic and public discussion of recent trends in the world economy. Among them are:

- Relationship between growth, trade and poverty
- Trends in inequality within and between countries
- Intellectual property rights
- Environmental and labour standards
- Volatility of terms- of- trade
- Financial stability

More topics in globalization are introduced in the course in the form of student presentations. The course stresses the importance of empirical research and devotes significant time to the empirical strategies that have been used by researchers in studying globalization.

Form of tuition
lecture
lectures, student presentations and discussions.

Course reading
Doel vak
Kennismaking met de twee belangrijkste resultaten uit de klassieke kansrekening, de wet van grote aantallen en de centrale limietstelling, met aandacht zowel voor maattheoretische fundering als voor toepassingen in concrete situaties

Inhoud vak
De cursus begint met een op maattheorie gebaseerde behandeling van allerlei probabilistische begrippen zoals kansruimten, stochastische grootheden en hun kansverdelingen, onafhankelijkheid van eventualiteiten, van collecties eventualiteiten, van experimenten en van stochastische grootheden. Belangrijke resultaten zijn hier het lemma van Borel-Cantelli, de consistentiestelling van Kolmogorov en diens 0-1-wet. De laatste stelling geeft, samen met het op Lebesgue-integratie gebaseerde verwachtingsbegrip, aanleiding tot verschillende wetten van grote aantallen; het is dan nodig eerst in te gaan op bijna zekere convergentie en convergentie in waarschijnlijkheid van stochastische variabelen. Na behandeling van convergentie in verdeling van stochastische variabelen en zwakke convergentie van kansmaten, komen een eenduidigheidsstelling, een omkeerstelling en een continuïteitsstelling aan de orde, zowel voor de verdelingsfunctie als voor de karakteristieke functie van een stochastische variabele. Ten slotte wordt aandacht besteed aan limietstellingen voor maxima en sommen van onafhankelijke stochastische variabelen, zoals de Centrale Limietstelling, en wordt kort stilgestaan bij stabiele en oneindig deelbare verdelingen.

Onderwijsvorm
Hoorcollege met vraagstukkenpraktikum.

Toetsvorm
Tussentijdse toetsen met opdrachten

Literatuur
K. van Harn en P.J. Holewijn, Grondslagen van de waarschijnlijkheidsrekening, collegedictaat.

---

**Grondslagen waarschijnheidsrekening**

<table>
<thead>
<tr>
<th>Vakcode</th>
<th>X_400027 (400027)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periode</td>
<td>Periode 4+5</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Voertaal</td>
<td>Nederlands</td>
</tr>
<tr>
<td>Faculteit</td>
<td>Faculteit der Exacte Wetenschappen</td>
</tr>
<tr>
<td>Coördinator</td>
<td>dr. K. van Harn</td>
</tr>
<tr>
<td>Docent(en)</td>
<td>dr. K. van Harn</td>
</tr>
<tr>
<td>Lesmethode(n)</td>
<td>Hoorcollege, Werkcollege</td>
</tr>
</tbody>
</table>
Vereiste voorkennis
Measure Theory (X_401028), Kansrekening I (X_400189) en Kansrekening II (X_400190).

Doelgroep
3W, 3W-B

Mathematical System Theory

<table>
<thead>
<tr>
<th>Course code</th>
<th>X_400180 (400180)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 4+5</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Coordinator</td>
<td>prof. dr. A.C.M. Ran</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>prof. dr. A.C.M. Ran</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture, Seminar</td>
</tr>
</tbody>
</table>

Course content
Many phenomena are characterized by dynamic behaviour where we are interested in a certain input/output behaviour. Examples are to be found in the exact and natural sciences (mechanics, biology, ecology), in engineering (air- and spacecraft design, mechanical engineering) as well as in economics and econometrics (macro- economical models, conjecture, trend and seasonal influences in demand and supply, production systems).

Systems theory is concerned with modeling, estimation and control of dynamical phenomena. During the course the following subjects will be treated: models and representations (linear systems, input-output, state space, transfer function, stochastic systems, spectrum), control (stabilisation, feedback, pole placement, dynamic programming, the LQ problem), and identification and prediction (parameter estimation, spectral analysis, Kalman- filter, model reduction).

Applications are in the area of optimal control and prediction.

Form of tuition
There is a lecture of two hours each week. In addition, there is a one-hour practicum, in which there is the possibility to ask questions about the compulsory computerpracticum. The practicum makes use of the Matlab package.

Type of assessment
The computerpracticum counts for 70 %, the oral examination concerns the theory and counts for 30 %.

Course reading
Chr. Heij, A.C.M. Ran and F. van Schagen, Introduction to Mathematical Systems Theory, Birkhauser Verlag

Target group
3W, mBA, mMth

Private Equity and Behavioral Corporate Finance

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_FIN_PEBCF ()</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 4</td>
</tr>
</tbody>
</table>
Course content
This course is build upon two blocks: private equity and behavioral corporate finance. Private equity is a major source of capital for new and established private firms. The size of the organized private equity market has grown dramatically since the early 1990s. Acknowledging that the European PE market is still largely underdeveloped, the objective of this course is to provide students valuable insights on the nature of the private equity business. This course seeks to understand how these organizations work; why they take the forms that they do, and where crucial problems and opportunities for innovation exist. We investigate the principal participants in this market, and the financial strategies that they employ. We also examine the strategies and incentives of the various players and how they maneuver through the business cycle, in particular by having a close look at the risk and return characteristics of PE during the recent economic downturn. Topics covered include: how private equity funds are raised, structured, and financed; contracting in private equity markets; valuation of private equity interests; sources of capital for private companies; strategies for value creation; mergers and acquisitions, and exit strategies.

Traditional finance assumes that market participants are rational, that is, they can access to and have the ability to process information correctly. However, real world experience and recent empirical studies suggest that markets are not fully efficient and that investors are not fully rational. The field of behavioral finance uses insights from psychology and argues that market participants are committed to certain heuristic-based biases such as overconfidence and loss aversion. We explore how individuals’ attitudes and behavior affect their own financial decisions, corporations, and the financial markets overall. We will make intensive use of real world applications, case studies, and empirical analyses. Students are expected to actively participate in the classroom sessions. Upon completion of this course, students will have gained substantial knowledge with respect to behavioral investment strategies, VC and PE, IPOs, LBOs and M&A, and understand the relevant behavioral factors and their possible influence onto company operations.

Form of tuition
Lectures and case studies

Type of assessment
Exam (70%); 2 assignments (each 15%)

Course reading
No textbook; recent journal publications

Recommended background knowledge
Sound knowledge of corporate finance and investments

Real Estate Management
Course objective
The course provides an introduction to the understanding and the analysis of real estate markets and the investment alternatives available to both debt and equity investors. A large part of the focus will be on residential real estate. We study both the owner occupied and rental markets and pay particular attention to financial aspects, in particular the mortgage market. The secondary market for mortgages, where institutional investors invest in "pools" of mortgages, is analyzed in detail, in particular in light of the recent financial crisis. The last part of the course deals with other forms of real estate that institutional investors may invest in. This part will cover other property types (offices, commercial real estate, etc.) and investment vehicles, such as REITS. Although the course takes an international perspective, special attention is given to the Dutch situation and, more specifically, the development of the Amsterdam South Axis.

Course content
We study the characteristics of mortgage loans used by households to finance the purchase of a house, the functioning of the Dutch housing market including the role of policy interventions (notably mortgage interest deductibility and spatial planning), and the role of housing corporations. The 'secondary market' for debt related to this financing is analyzed with a focus on the various instruments (such as CDO's and CMO's) that have played on important role in the current financial crisis. Finally, we also look at 'the other side' of the financing of real estate, namely, we take the perspective from an (institutional) investor, such as a pension fund, who considers real estate as one of many available asset classes. We will study the main characteristics in terms of risk and returns of the different forms of real estate available to the investor (such as investing in mortgage pools, investing in buildings, securitized real estate, etc), as well as by property type (such as residential versus commercial real estate). After following this course you should be able to understand:
- the main characteristics of the most popular types of mortgage loans
- the pros and cons of fixed rate and adjustable rate mortgages
- the impact of fiscal measures on mortgage payments
- the role of the housing corporations on the Dutch rental housing market
- the importance of the secondary market in mortgages, as well as the available instruments characteristics of real estate as an asset class for institutional investors such as pension funds
- the risk and returns characteristics of the main investments vehicles in real estate available to an institution investor.

Real Estate Management is a joint effort of the departments of Spatial Economics and Finance and Financial Sector Management.
Type of assessment
assignment
20 percent
written interim examination
80 percent

Course reading
- Additional course material will be provided on Blackboard

Research Project Finance

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_FIN_RPFN (60432010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 3</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. D.G. Stefanova</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>prof. dr. A.C.F. Vorst, dr. A. van Haastrecht, dr. K.F. Raff</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Study Group</td>
</tr>
</tbody>
</table>

Course objective
This course will allow students to apply their knowledge acquired so far to applied research projects in various fields of finance. Working in teams of 3-4, students will investigate a well delimited area by reviewing relevant existing academic as well as practitioners oriented literature. They will empirically apply the theory to real life data. Students will be encouraged to gather information from various sources, including from practitioners in the industry via for example surveys. Students will have to draw upon the material taught both during their undergraduate degree and during their Master in Finance program. Upon completion, students should be able to:
- identify the relevant academic literature for their area of research
- formulate precise research questions and hypotheses in a specific field based on the academic literature - gather data to test their hypotheses
- choose appropriate (statistical) methodology for the research, implement this on the data, and interpret the findings
- communicate their research set-up and findings clearly, both orally and in writing
- carefully plan a demanding project on a tight time-line
- cooperate in a team to increase team output on a research project

Course content
Before the end of Period 2, students will be requested to form groups and make a choice from a provided list of projects. This will be communicated via blackboard and VU-email. Each project includes a detailed description, allowing the students to have some understanding of the implications of the topic. The projects will cover various areas in finance, both in the area of financial markets and corporate finance. A few projects requiring a strong background in econometrics will also be provided for participants of the Quantitative Finance Track. Starting references from the relevant academic literature will be provided, but
students should actively look for additional relevant literature. Between the end of Period 2 and the beginning of this course in January (period 3), students will prepare an initial set-up for their project and carry out a preliminary literature review on their subject. They will present this set-up to the other students in class during the start of period 3. The actual research can then go ahead at full speed during the actual four weeks of period 3. During this initial preparation period, as well as during period 3, individual meetings with the lecturer can be organized. During period 3, each group will be required to:
- make an concise initial, kick-off presentation
- make an intermediate presentation to all other groups
- make a final presentation to all other groups at the end of the period
- write up a research paper (usually 40 to 80 pages), written as a scientific paper, presenting their research, which includes the literature overview and the empirical findings.


Students are encouraged to strengthen their applied research outcomes by input from practitioners from the financial industry.

Form of tuition
- individual meetings with each group
- three plenary sessions for presentations of research set-up and (intermediate) results

Type of assessment
The course grade is based on the final report, the presentation of the results, and the student’s discussion participation (as a discussant of one of the presented projects, as well as for his/her contribution to the discussion in the plenary sessions).

Course reading
A literature review is required for each project. Starting references from the relevant academic literature are provided by the supervisor.

Entry requirements
Students should have a good overall knowledge of the various topics taught in the courses so far. For Finance students, this includes the material of Empirical Finance. For Quantitative Finance Track students, we require knowledge of Advanced Econometrics.

All projects require students to work with real life data, for which students may choose an appropriate software package of their liking (Excel, or more sophisticated econometric / statistical software) and appropriate available databases (Datastream, SDC, CRSP, Compustat, ...) or proprietary data sources.

Simulation and Stochastic Systems

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_EORM_SSS (64412010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 4</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
</tbody>
</table>
Course objective
The objective of this course is to learn how to develop and execute a simulation study of a stochastic system. This incorporates all aspects of an operations research study: data collecting, modeling, analyzing, programming, writing a report and presenting the results.

Course content
The course gives a broad treatment of the important aspects of stochastic simulation and its applications to queuing, manufacturing and financial models. The topics covered include discrete-event simulation, random number generators, generating random variates, statistical output analysis, steady-state simulation, variance reduction techniques, rare-event simulation, and stochastic optimization. The emphasis is on the mathematical analysis of properties of these simulation methods. There will be assignments in which the students apply simulation issues to problems either by theoretical analysis, or by programming. The simulation programs are written in C, C++, Java or Matlab. Towards the end of the course the student studies a scientific paper on a simulation topic and gives a presentation of it.

Form of tuition
lecture and tutorial

Type of assessment
1. homework problems
2. Paper presentation
3. Written exam

Course reading

Entry requirements

Recommended background knowledge

Stochastic Optimization

<table>
<thead>
<tr>
<th>Vakcode</th>
<th>X. 400336 (400336)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periode</td>
<td>Periode 1+2</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Voertaal</td>
<td>Engels</td>
</tr>
<tr>
<td>Coördinator</td>
<td>dr. S. Bhulai</td>
</tr>
<tr>
<td>Docent(en)</td>
<td>dr. S. Bhulai</td>
</tr>
<tr>
<td>Lesmethode(n)</td>
<td>Hoorcollege</td>
</tr>
</tbody>
</table>

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.

**Toetsvorm**
Programming and written exercises, final examination.

**Literatuur**
Lecture notes (will be handed out during lectures).

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

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

**Doelgroep**
mBA, mBa-D, mMath, mSFM

---

**Stochastic Processes for Finance**

<table>
<thead>
<tr>
<th>Vakcode</th>
<th>X 400352 (400352)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periode</td>
<td>Periode 1+2</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Voertaal</td>
<td>Engels</td>
</tr>
<tr>
<td>Faculteit</td>
<td>Faculteit der Exacte Wetenschappen</td>
</tr>
<tr>
<td>Coördinator</td>
<td>dr. S. Gugushvili</td>
</tr>
<tr>
<td>Docent(en)</td>
<td>dr. S. Gugushvili</td>
</tr>
<tr>
<td>Lesmethode(n)</td>
<td>Hoorcollege</td>
</tr>
</tbody>
</table>

**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, caps and floors, 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, by studying models for the "term structure of interest rates", and to risk measurement and management. Foremost, we develop the theory of no-arbitrage pricing of derivatives, which are basic tools for risk management.

**Onderwijsvorm**
Lectures and exercises.

**Toetsvorm**
Computer assignments / Written examination.

**Literatuur**
Lecture notes.
Bjork, T., Arbitrage Theory in Continuous Time.
Shreve, S., Stochastic Calculus for Finance II: Continuous-Time Models.

**Vereiste voorkennis**
Introductory probability theory and statistics, calculus.

**Aanbevolen voorkennis**
Introductory probability theory and statistics, calculus.

**Doelgroep**
mBA, mBA-D, mMath, mSFM

**Overige informatie**

**Strategic and Cooperative Decision Making**

<table>
<thead>
<tr>
<th>Course code</th>
<th>E_EORM_SCDM (64422010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Period 2</td>
</tr>
<tr>
<td>Credits</td>
<td>6.0</td>
</tr>
<tr>
<td>Language of tuition</td>
<td>English</td>
</tr>
<tr>
<td>Faculty</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coordinator</td>
<td>dr. J.R. van den Brink</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>dr. J.R. van den Brink</td>
</tr>
<tr>
<td>Teaching method(s)</td>
<td>Lecture</td>
</tr>
</tbody>
</table>

**Course objective**
The aim of this course is to learn and apply methods and techniques from cooperative and noncooperative game theory to economic and managerial problems. Students should be able to understand and to apply results that recently appeared in the international journals.

Course content
In this course we study strategic and cooperative decision making in situations where more than one party or agent is involved. In these situations the outcome is the result of the individual decisions made by the agents. In strategic decision theory we focus on the decisions made by the agents, where each agent takes account of the fact that its decision influences the outcome, and therefore the decision problem of the other agents. Agents behave strategically if each agent tries to behave in a way that is best for itself. In cooperative decision theory we focus on the outcome (and not on the individual decisions), taking into account the interests of all agents. We study different criteria that an outcome can satisfy, such as efficiency or equity, and look how to find a compromise between these criteria when they are conflicting. The methods we use to analyse and solve these problems borrow from (non-cooperative and cooperative) game theory, general equilibrium theory and social choice theory. The topics come from the field of economics and operations research and include: bargaining problems, auctions, cost sharing and allocation problems, operations research games, market games, assignment problems, profit distribution, voting problems, score rules, location problems and networks.

Form of tuition
lecture
working group

Type of assessment
written interim examination
and presentations.

Course reading
- A reader including a selection of recent articles

Entry requirements
- Mathematical Economics 1
- Recommended: Mathematical Economics 2

Thesis

<table>
<thead>
<tr>
<th>Vakcode</th>
<th>E_FIN_THS ()</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periode</td>
<td>Ac. Jaar (september)</td>
</tr>
<tr>
<td>Credits</td>
<td>18.0</td>
</tr>
<tr>
<td>Voertaal</td>
<td>Engels</td>
</tr>
<tr>
<td>Faculteit</td>
<td>Fac. der Economische Wet. en Bedrijfsk.</td>
</tr>
<tr>
<td>Coördinator</td>
<td>prof. dr. M. van der Nat</td>
</tr>
</tbody>
</table>

Vrije Universiteit Amsterdam - Fac. der Economische Wet. en Bedrijfsk. - M Finance - 2011-2012

6-3-2013 - Pagina 31 van 32
Course objective
To gain insights in economic time series modelling with a focus on theory, methods and computations.

Course content
This course focuses on the advances of theory and computational methods for time series econometrics. A methodology of econometric programming is explored for a number of selected topics in time series analysis. In particular, time series properties in time and frequency domains, different modeling strategies, likelihood evaluations, filtering methods and Monte Carlo simulation methods are studied. Theory and methods are studied thoroughly while some computer programs need to be developed for the implementation of the methods.

Form of tuition
lecture
tutorial

Type of assessment
written interim examination
50 percent
written assignments
50 percent

Course reading
Selection of literature: