



# **Teaching and Examination Regulations**

MASTER's Degree Programme

Stochastics and Financial Mathematics

B. Programme-specific section

Academic year 2017-2018

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## **Section B: Programme-specific section**

### **1. General provisions**

#### **Article 1.1 Definitions**

Not applicable

#### **Article 1.2 Degree programme information**

1. The programme Stochastics and Financial Mathematics (CROHO number 60801) is offered on a full-time basis and the language of instruction is English.
2. The programme consists of 120 EC.
3. A unit of study comprises 6 EC or a multiple thereof. The units of study listed below have a different size:

<b>Course code</b>	<b>Course components</b>	<b>EC</b>
X_400323	Asymptotic Statistics	8
XMM_0014	Discrete Choice Analysis: Theory and Applications	8
XMM_0005	Forensic Probability and Statistics	8
X_400328	Functional Analysis	8
XMM_0002	Machine Learning Theory	8
X_400244	Measure Theoretic Probability	8
X_400330	Partial Differential Equations	8
XMM_0012	Percolation: from Introduction to Frontiers of Current Research	8
X_400512	Scientific Writing in English BA/M/SFM	3
XMM_0008	Statistical Theory for High- and Infinite-Dimensional Models	8
X_400339	Stochastic Processes	8
X_400470	Stochastic Integration	8
X_400571	Time series	8

#### **Article 1.3 Intake dates**

The programme is offered starting in the first semester of the academic year (1 September) and starting in the second semester (1 February). The intake date(s) mentioned in this paragraph ensure(s) that a programme can be completed within the nominal study duration set for the programme.

### **2. Programme objectives and exit qualifications**

#### **Article 2.1 Programme objective**

The programme aims to acquire sufficient knowledge, skills and insight within the field of Stochastics and Financial Mathematics, and any related disciplines, to be able to operate as an independent professional at an academic level, and to be a suitable candidate for a subsequent course of study leading to a career in research or development.

Another aim of the programme is to develop students' understanding of the interrelationships between academic disciplines, as well as their sense of social responsibility.

#### **Article 2.2 Exit qualifications**

The graduate:

- has thorough theoretical and practical knowledge of the fields of Modern Probability, Statistics and Stochastic Operations Research and their application in financial mathematics, the life sciences or in industry, for example;
- has insight into the development and the heuristics of modern mathematics, especially Stochastics, and has gained research experience in an area of Stochastics;
- is capable of becoming conversant in other sub-fields of Stochastics within a reasonable period of time;
- is capable of formulating a plan for a research project based on a broad research question;

- is capable of analysing and formulating research results, and of drawing conclusions from them;
- is capable of writing a report and of participating in a discussion on a topic related to the field of study;
- is capable of studying the professional literature (including international publications) in relevant sub-fields, and of utilizing the relevant content;
- is capable of applying knowledge of Stochastics in a broader (multidisciplinary) context, and has experience of using probabilistic models to examine problems in fields such as economics, biology or physics;
- has sufficient knowledge of, and insight into, the social role of Stochastics and Financial Mathematics to decide on a responsible choice of profession and professional practice;
- is capable of cooperating with others, of imparting knowledge to others, and of delivering a lecture both to specialists and to a wider audience.

The graduate who focuses on scientific research is able to:

- study and combine mathematical literature from various sources, and augment the field of mathematics with contributions of their own;
- contextualize the results and conclusions obtained, within the framework of results obtained by others.

The graduate who focuses on applications of Stochastics in a business setting or for an organization is able to:

- define a solution-based scientific question from problems of a quantitative and/or stochastic nature in the organization or business;
- implement such questions in the form of targeted research;
- interpret and present data obtained from analyses conducted on different scales and at various levels of abstraction;

### 3. Further admission requirements

#### Article 3.1 Admission requirements

1. Applicants will be admitted to the degree programme if they hold a letter of acceptance, issued by or on behalf of the Faculty Board because they have demonstrated that they meet the knowledge, understanding and skills requirements of the final level of attainment in a university Bachelor's degree programme.
2. Prior education requirements:
  - 3.1.2.1. Registration for the Master's programme in Stochastics and Financial Mathematics is open to anyone who is in possession of a Bachelor's degree in Mathematics or Technical Mathematics or (with sufficient mathematical content) in Business Analytics or Econometrics or Actuarial Sciences, from a Dutch university, and whose English-language proficiency is at least equivalent to pre-university final-exam level (VWO in the Netherlands).
  - 3.1.2.2. An applicant with a university Bachelor's degree in a field other than specified in paragraph 3.1.2.1 may be admitted to the programme by the Examination Board if the following conditions have been met:
    - the applicant's prior education, including any supplementary work, contains at least 90 credits of mathematics;
    - the applicant has reached a final attainment level for stochastics equivalent to the Bachelor's in Mathematics as taught at VU University Amsterdam;
    - the applicant's prior education meets the qualifications of a university Bachelor's degree programme as defined in the Dublin descriptors;
    - the applicant's English-language proficiency is at least equivalent to pre-university final-exam level (VWO in the Netherlands).
  - 3.1.2.3. The Examination Board may impose additional requirements on the final Master's degree assessment for the programme in Stochastics and Financial Mathematics.
3. If the degree programme consists of distinct programmes, the Examination Board will assess whether the applicant has met the applicable requirements.

4. Those not yet in possession of a Bachelor's degree, but who meet the admission requirements as regards the knowledge, insight and skills specified in paragraph 2, may on request be granted conditional admission to the associated Master's programme, insofar as failure to grant admission would result in undue unfairness.

#### Article 3.2 Pre-Master's programme

1. Applicants who have a Bachelor's degree in a field that sufficiently corresponds to the field of the Master's programme may request admission to the pre-Master's programme.
2. A certificate stating that the student has successfully completed the pre-Master's programme serves as a letter of acceptance to the associated Master's programme in the next academic year.
3. The letter of acceptance relates exclusively to the academic year following the academic year in which the application for the letter of acceptance was submitted, unless the Executive Board decides otherwise.

#### Article 3.3 Limited programme capacity

Not applicable

#### Article 3.4 Final deadline for registration

A candidate must submit a request to be admitted to the programme through Studielink before 1 June in the case of Dutch students, before 1 April in the case of EU students and before 1 February in the case of non-EU students. Under exceptional circumstances, the Examinations Board may consider a request submitted after this closing date.

#### Article 3.5 English language requirement for English-language Master's programmes

1. The proficiency requirement in English as the language of instruction can be met by the successful completion of one of the following examinations or an equivalent:
  - IELTS: 6.5
  - TOEFL paper based test: 580
  - TOEFL internet based test: 92-93
  - Cambridge Advanced English: A, B or C.
  - A command of English equivalent to pre-university final-exam level (VWO).
2. Exemption is granted from the examination in English referred to in the first paragraph to students who, within two years of the start of the programme:
  - met the requirements of the VU test in English language proficiency TOEFL ITP, with at least the scores specified in paragraph 1, or
  - had previous education in secondary or tertiary education in an English-speaking country as listed on the VU website, or
  - have an English-language 'international baccalaureate' diploma]

#### Article 3.6 Free curriculum

1. Subject to certain conditions, the student has the option of compiling a curriculum of his/her own choice which deviates from the curricula prescribed by the programme.
2. The concrete details of such a curriculum must be approved beforehand by the most appropriate Examinations Board.
3. The free curriculum is put together by the student from the units of study offered by Vrije Universiteit Amsterdam or another institution of higher education and must at least have the size, breadth and depth of a regular Master's programme.

### 4. Curriculum structure

#### Article 4.1 Composition of programme

1. The programme has a study load of 120 credits and consists of the following components:
  - a. compulsory educational units
  - b. practical components
  - c. electives
2. Notwithstanding the provisions of paragraph 1, students may compose their own Master's programme under certain circumstances and with the prior approval of the Examination Board.

3. The degree programme has a study load of 120 credits. One credit is equivalent to 28 hours of study.
4. The programme is run jointly with the University of Amsterdam and Utrecht University.
5. Before starting an internship and/or graduation project, the student must have earned all other programme credits. A shortfall of 6 credits is permissible.

#### Article 4.2 Compulsory units of study

Abbreviations of teaching method and examination format are defined in Article 1.1.

The compulsory units of study are (53 EC required):

Course code	Course component	EC	Period	Level
XM_400502	Master Project Stochastics and Financial Mathematics	36	Ac. Year	600
X_400244	Measure Theoretic Probability	8	1+2	400
X_400512	Scientific Writing in English M/SFM	3	4	400
XM_41011	Master Seminar in Stochastics	6	1+2, 4+5	400

#### Article 4.3 Practical exercise

Except for those practical components incorporated in the compulsory units of study above and in relevant electives, the programme has no separate practical exercise.

#### Article 4.4 Electives

Students may choose elective courses subject to restrictions. They must choose at least 2 Advanced SFM courses, and 2 Financial Mathematics courses. The remaining electives must be chosen from the list of Designated SFM courses. Students are free to choose at most 12 EC of other electives (for example outside Mathematics).

#### Constrained choice Financial Mathematics, at least 2 out of 4 (12 EC required):

Course code	Course component	EC	Period	Level
X_418091	Interest Rate Models	6	1+2	500
X_400535	Portfolio Theory	6	1+2	500
X_400352	Stochastic Processes for Finance	6	1+2	400
XMU_418045	Computational Finance	6	4+5	400

#### Constrained choice advanced SFM courses (at least 2 out of 8):

Course code	Course component	EC	Period	Level
XMM_0014	Discrete Choice Analysis: Theory and Applications	8	1+2	500
X_418091	Interest Rate Models	6	1+2	500
X_400535	Portfolio Theory	6	1+2	500
XMU_0002	Queues & Levy Fluctuation Theory	6	1+2	400
XMM_0012	Percolation: from Introduction to Frontiers of Current Research	8	4+5	500
XMM_0008	Statistical Theory for High- and Infinite-Dimensional Models	8	4+5	500
X_405113	Statistics for High-Dimensional Data	6	4+5	400
X_405110	Statistics for Networks	6	2018/19	600

#### Designated SFM courses:

Course code	Course component	EC	Period	Level
X_400076	Applied Analysis: Financial Mathematics	6	1+2	400
X_400392	Applied Stochastic Modeling	6	1+2	400
X_400323	Asymptotic Statistics	8	1+2	500
XMM_0014	Discrete Choice Analysis: Theory and Applications	8	1+2	500
XMM_0005	Forensic Probability and Statistics	8	1+2	500
X_400328	Functional Analysis	8	1+2	500
X_418091	Interest Rate Models	6	1+2	500
XMM_0002	Machine Learning Theory	8	1+2	600
X_400244	Measure Theoretic Probability	8	1+2	400
X_400330	Partial Differential Equations	8	1+2	500
X_400535	Portfolio Theory	6	1+2	500
X_400258	Simulation Methods in Statistics	6	1+2	400

X_400418	Statistical Models	6	1+2	400
X_400336	Stochastic Optimization	6	1+2	400
X_400352	Stochastic Processes for Finance	6	1+2	400
XMU_0001	Stochastic Simulation	6	1+2	400
XMU_418045	Computational Finance	6	4+5	400
X_400422	Optimization of Business Processes	6	4+5	400
XMM_0012	Percolation: from Introduction to Frontiers of Current Research	8	4+5	500
X_400397	Queueing Theory	6	4+5	400
XMU_0002	Queues & Levy Fluctuation Theory	6	4+5	400
XMU_41015	Statistical Theory for High- and Infinite-Dimensional Models	6	4+5	500
X_405113	Statistics for High-Dimensional Data	6	4+5	400
X_400454	Stochastic Differential Equations	6	4+5	500
X_400470	Stochastic Integration	8	4+5	400
X_400339	Stochastic Processes	8	4+5	400
X_400571	Time series	8	4+5	500

If the student wishes to take a different course than the units of study listed, advance permission must be obtained in writing from the Examinations Board.

#### Article 4.5 Sequence of examinations

Any examinations and/or practical exercises that may only be taken once the exams of other (prior) components have been passed:

- Before starting an internship and/or graduation project, the student must have earned all other programme credits. A shortfall of 6 credits is permissible.

#### Article 4.6 Participation in practical exercise and tutorials

1. Student are expected to participate actively in all degree components for which they are registered.
2. In addition to the general requirement regarding active participation, the study guide details additional requirements for each degree component, as well as component attendance requirements.
3. At the start of each degree component, a specification will be made available which details:
  - The final attainment levels of the degree component;
  - The study guidelines for passing the degree component;
  - The way in which the final attainment levels are assessed;
  - The regulations for examinations and resits;
  - The guidance provided by lecturers during scheduled hours and otherwise;
  - Component attendance requirements;
  - The provision of feedback to the student on assignments and reports submitted, and presentations given during the degree component.
4. If a student is prevented by force majeure from attending a required degree component, then the student must send written notification of his or her absence to the examiner and the study advisor as soon as possible. The examiner may, after consultation with the study advisor, give the student an alternative assignment.
5. Absence from degree components with required attendance is only allowed in the case of force majeure.
6. In the event of inadequate participation, either qualitative or quantitative, the examiner may exclude the student from further participation in the degree component or a part of the degree component. The details of the student's inadequate participation must be recorded in advance and approved by the Director of Studies.

#### Article 4.7 Maximum exemption

Not applicable

#### Article 4.8 Validity period for results

No further specific provisions to article 4.8 of TER part A.

#### Article 4.9 Degree

Students who have successfully completed their Master's final examination are awarded a Master of

Science degree. The degree awarded is stated on the diploma. If it is a joint degree, this will also be stated on the diploma.

## 5. Transitional and final provisions

### Article 5.1 Amendments and periodic review

1. Any amendment to the Teaching and Examination Regulations will be adopted by the faculty board after taking advice, and if necessary approval by the Programme Committee concerned. A copy of the advice will be sent to the authorized representative advisory body.
2. An amendment to the Teaching and Examination Regulations requires the approval of the authorized representative advisory body if it concerns components not related to the subjects of Section 7.13, paragraph 2 sub a to g and v of the WHW and the requirements for admission to the Master's programme.
3. An amendment to the Teaching and Examination Regulations can only pertain to an academic year that is already in progress if this does not demonstrably damage the interests of students.

### Article 5.2 Transitional provisions

Notwithstanding the current Teaching and Examination Regulations, the following transitional provisions apply for students who started the programme under a previous set of Teaching and Examination Regulations: Not applicable.

### Article 5.3 Publication

1. The faculty board will ensure the appropriate publication of these Regulations and any amendments to them.
2. The Teaching and Examination Regulations will be posted on VUnet.

### Article 5.4 Effective date

These Regulations enter into force with effect from 1 September 2017.

Advice from Programme Committee, on 20 April 2017

Advice from Examination Board of the Faculty of Science, on 10 November 2016

Approved by authorized representative advisory body, on 6 July 2017

Adopted by the Board of the Faculty of Science, on 21 July 2017



## Appendix I

List of articles that must be included in the OER pursuant to the WHW (articles in framed boxes):

### Section A

Art. 1.1	7.13, para 1, WHW
Art. 2.1	7.13, para 2 sub w
Art. 3.2	7.13, para 2 sub e
Art. 4.2	7.13, para 2 sub h and l
Art. 4.3	7.13, para 2 sub n
Art. 4.4	7.13, para 2 sub o
Art. 4.5	7.13, para 2 sub j, h
Art. 4.7	7.13, para 2 sub r
Art. 4.8	7.13, para 2 sub k
Art. 4.9	7.13, para 2 sub p
Art. 4.10	7.13, para 2 sub q
Art. 4.11	7.13, para 2 sub a
Art. 5.1	7.13, para 2 sub u
Art. 5.2	7.13, para 2 sub m

### Section B

Art. 1.2	7.13, para 2 sub i
Art. 2.1	7.13, para 1 sub b, c
Art. 2.2	7.13, para 2 sub c
Art. 3.1	7.25, para 4
Art. 4.1	7.13, para 2 sub a
Art. 4.2	7.13, para 2 sub e, h, j, l
Art. 4.3	7.13, para 2 sub t
Art. 4.4	7.13, para 2 sub e, h, j, l
Art. 4.5	7.13, para 2 sub s
Art. 4.6	7.13, para 2 sub d
Art. 4.8	7.13, para 2 sub k