MSc Mathematics and SFM Manual 2018/19

About this document 2
Mathematics: Algebra and Geometry Track 3
Mathematics: Analysis and Dynamical Systems Track 6
Mathematics: Stochastics Track 9
Mathematics: Biomedical Mathematics Track 12
Mathematics: Education Track 14
Mathematics: Teachers Track 15
Stochastics and Financial Mathematics 16
Final remarks 18
Appendix: list of courses 19
About this document

Goal
This document was written to assist VU students in choosing courses within the two mathematical master programs and their tracks:

- **Mathematics**, consisting of six tracks:
  - Algebra and Geometry
  - Analysis and Dynamical Systems
  - Stochastics
  - Biomedical Mathematics
  - Education
  - Teachers
- **Stochastics and Financial Mathematics**

This manual contains information on the overall structure of the Master programs, and lists courses offered in 2018/19 per track, indicating both their level and relevance. Also, several “suggested lines” are given. These are clusters of related courses that offer the possibility of going in depth into several specialisations.

We recommend that you discuss your program with the coordinator of your master program (Corrie Quant for Mathematics, Wouter Kager for SFM) as early as possible.

Other sources of information
Detailed course descriptions can be found in the online UvA and VU study guides, and on the Mastermath website.

Non-standard programs
If you want to follow a non-standard program (e.g. a major/minor, a double master program, a free program, interdisciplinary program, or if you simply want to include certain courses that are not listed in the program below), then in most cases you will need to have your proposed program approved by the Examination Board. Contact the coordinator of the master program as soon as possible.

Legal disclaimer
No rights can be derived from this document, the only legally binding source regarding your master degree is the Teaching and Examination Regulations (commonly known by its Dutch abbreviation OER). You can find this on VUNET.
Mathematics: Algebra and Geometry Track

Program outline

- **6EC**: Master Seminar in Algebra, Geometry and Mathematical Physics (year 1)
- **3EC**: Scientific Writing in English (year 1)
- **36EC**: Master Project Mathematics (year 2)
- **60EC**: Mathematics courses, consisting of
  - At least three courses out of:
    * Algebraic Geometry 1
    * Algebraic Methods in Combinatorics
    * Algebraic Number Theory
    * Algebraic Topology 1
    * Differential Geometry
    * Lie Groups and Lie Algebras
    * Quivers
    * Riemann Surfaces
  - At least 2 advanced Algebra and Geometry courses
  - Remainder (about 30EC) mathematics courses (all tracks)
- **15EC**: Free (must be master level; can be math, literature, ...)

Fall 2018

Master Seminar

- Master Seminar in Algebra, Geometry and Mathematical Physics (@UvA)

Suggested basic courses

- Algebraic Geometry 1 (Mastermath)
- Algebraic Number Theory (Mastermath)
- p-Adic Numbers and Applications (Mastermath)
- Algebraic Topology 1 (Mastermath)
- Commutative Algebra (Mastermath)
- Cryptology (Mastermath)
- Quivers (UvA)

Advanced courses

- Advanced Algebraic Geometry: Abelian Varieties (Mastermath)
- Analytic Number Theory (Mastermath)
- Differential Geometry (Mastermath)
- Topos Theory (Mastermath)
Mathematics: Algebra and Geometry Track

Related courses
- Ergodic Theory (Mastermath)
- Functional Analysis (Mastermath)

Spring 2019

Master Seminar
- Master Seminar in Algebra, Geometry and Mathematical Physics (@UvA)

Suggested basic courses
- Algebraic Methods in Combinatorics (Mastermath)
- Coding and Cryptography (VU)
- Coding Theory (Mastermath)
- Elliptic Curves (Mastermath)
- Lie Groups and Lie Algebras (Mastermath)
- Operator Algebras (Mastermath)
- Riemann Surfaces (Mastermath)

Advanced courses
- Algebraic Geometry 2 (Mastermath)
- Algebraic Topology 2 (Mastermath)
- Algebraic Topology in Dynamical Systems (Mastermath)
- Topology in Physics (Mastermath)
- Geometric PDE (Mastermath)
- Mirror Symmetry (UvA)
- Multiple Zeta Functions (Mastermath)
- Selected Areas in Cryptology (Mastermath)
- Topics in Number Theory (UvA)
- Symplectic Geometry
- Seminar Algebra (VU)

Suggested lines

Algebraic Geometry
- Basic: Algebraic Geometry 1, Commutative Algebra
- Advanced: Algebraic Geometry 2, Advanced Algebraic Geometry: Abelian Varieties, Seminar Algebra
- Related: Algebraic Topology 1, p-Adic Numbers and Applications, Riemann Surfaces, Elliptic Curves

Differential Geometry
- Basic: Lie Groups and Lie Algebras, Riemann Surfaces
- Advanced: Differential Geometry, Algebraic Topology in Dynamical Systems, Symplectic Geometry
Mathematics: Algebra and Geometry Track

• Related: Algebraic Topology 1, Topology in Physics, Functional Analysis

Mathematical Physics

• Basic: Algebraic Topology 1, Lie Groups and Lie Algebras
• Advanced: Differential Geometry, Topology in Physics, Symplectic Geometry
• Related: Algebraic Geometry 1, Functional Analysis, Operator Algebras

Number Theory

• Basic: Algebraic Number Theory, p-Adic Numbers and Applications, Analytic Number Theory, Elliptic Curves,
• Advanced: Multiple Zeta Functions, Topics in Number Theory, Algebraic Geometry 2,
• Related: Algebraic Geometry 1, Commutative Algebra, Riemann Surfaces

Research staff in Algebra and Geometry

UvA

VU
Magnus Botnan, Sander Dahmen, Oliver Fabert, Rob de Jeu, Federica Pasquotto, Jan Sanders, Rob van der Vorst.
Mathematics: Analysis and Dynamical Systems Track

Program outline

- **6EC**: Master Seminar in Analysis and Dynamical Systems (year 1)
- **3EC**: Scientific Writing in English (year 1)
- **36EC**: Master Project Mathematics (year 2)
- **60EC**: Mathematics courses, consisting of
  - At least 3 courses out of
    * Functional Analysis
    * Partial Differential Equations
    * Dynamical Systems
    * Control of Infinite Dimensional Systems
  - At least 2 advanced Analysis and Dynamical Systems courses
  - Remainder (about 30EC): mathematical courses (all tracks)
- **15EC**: Free (must be master level; can be math, literature, . . . )

---

**Fall 2018**

**Master Seminar**
- Master Seminar in Analysis and Dynamical Systems (@UvA)

**Suggested basic courses**
- Continuous Optimization (Mastermath)
- Control of Infinite Dimensional Systems (VU, 18/19)
- Dynamical Systems (Mastermath)
- Functional Analysis (Mastermath)
- Mathematical Biology (Not in 18/19)
- Parallel Algorithms (Mastermath)
- Partial Differential Equations (Mastermath)
- Numerical Linear Algebra (Mastermath)

**Advanced courses**
- Advanced Complex Analysis (Mastermath)
- Advanced Topics in Stochastic Analysis (UvA)
- Differential Geometry (Mastermath)
- Symmetries and Conservation Laws of nonlinear PDE (Mastermath)
Related courses
- Mathematical Biology (Not in 18/19)
- Measure Theoretic Probability (Mastermath)

Spring 2019

Master Seminar
- Master Seminar in Analysis and Dynamical Systems (@VU)

Suggested basic courses
- Applied Finite Elements (Mastermath)
- Numerical Bifurcation Analysis of Large-scale Systems (Mastermath)
- Riemann Surfaces (Mastermath)
- Stochastic Differential Equations (Mastermath)

Advanced courses
- Nonlinear Waves (Mastermath)
- Inverse Problems in Imaging (Mastermath)
- Algebraic Topology in Dynamical Systems (Mastermath)
- Advanced Complex Analysis (Mastermath)
- Geometric Functional Analysis and its Applications (Mastermath)
- Numerical Methods for Time Dependent PDEs (Mastermath)
- Numerical Bifurcation Analysis of Large-scale Systems (Mastermath)
- Geometric PDE (Mastermath)

Related courses
- Lie Groups and Lie Algebras (Mastermath)
- Operator Algebras (Mastermath)
- Symplectic Geometry (Mastermath)
- Stochastic Differential Equations (Mastermath)

Suggested lines

Dynamical systems
- Basic: Dynamical Systems, Partial Differential Equations, Numerical Bifurcation Analysis of Large-scale Systems
- Advanced: Algebraic Topology in Dynamical Systems, Nonlinear Waves
- Related: Functional Analysis, Inverse Problems in Imaging, Mathematical Biology (Not in 18/19), Ergodic Theory, Stochastic Differential Equations

Numerical Analysis
- Basic: Advanced Linear Programming, Numerical Linear Algebra, Partial Differential Equations, Applied Finite Elements
Mathematics: Analysis and Dynamical Systems Track

- Advanced: Inverse Problems in Imaging, Numerical Methods for Time Dependent PDEs
- Related: Functional Analysis, Parallel Algorithms

Research staff in Analysis and Dynamical Systems

UvA
Jan Brandts, Daan Crommelin, Ale Jan Homburg, Han Peters, Rob Stevenson, Chris Stolk, Jan Wiegerinck.

VU
Jan Bouwe van den Berg, Magnus Botnan, Frank Bruggeman, Oliver Fabert, Ale Jan Homburg, Joost Hulshof, Rien Kaashoek, Federica Pasquotto, Bob Planqué, André Ran, Bob Rink, Jan Sanders, Rob van der Vorst.
Mathematics: Stochastics Track

Program outline

• **6EC**: Master Seminar in Stochastics (two semesters, year 1)
• **3EC**: Scientific Writing in English (year 1)
• **36EC**: Master Project Mathematics (year 2)
• **60EC**: Mathematics courses, consisting of
  – Compulsory courses:
    * Asymptotic Statistics
    * Measure Theoretic Probability
    * Stochastic Processes
  – At least 2 advanced Stochastics courses
  – Remainder (about 30C): mathematics courses (all tracks)
• **15EC**: Free (must be master courses; can be math, literature, ...)

Fall 2018

Master Seminar

• Master Seminar in Stochastics (@UvA)

Suggested basic courses

• Advanced Machine Learning (VU)
• Applied Stochastic Modelling (VU)
• Asymptotic Statistics (Mastermath)
• Forensic Probability and Statistics (Mastermath)
• Functional Analysis (Mastermath)
• Heuristics Methods in Operations Research (Mastermath)
• Machine Learning Theory (Mastermath)
• Measure Theoretic Probability (Mastermath)
• Partial Differential Equations (Mastermath)
• Simulation Methods in Statistics (UvA)
• Statistical Models (VU)
• Stochastic Networks (UvA)
• Stochastic Optimization (VU)
• Stochastics Processes for Finance (VU)
• Stochastic Simulation (UvA)
• Uncertainty Quantification and Data Assimilation (UvA)

Advanced courses

• Advanced Topics in Stochastic Analysis (UvA)
• Ergodic Theory (Mastermath)
• Interacting Particle Systems: Theory and Applications (Mastermath)
• Interest Rate Models (UvA)
• Portfolio Theory (UvA)

Related courses
• Mathematial Biology (Not in 18/19)
• Statistical Theory for High- and Infinite-Dimensional Models (UvA, not every year)

---

Spring 2019

Master Seminar
• Master Seminar in Stochastics (@VU)

Suggested basic courses
• Applied Statistics (Mastermath)
• Queueing Theory (Mastermath)
• Scheduling (Mastermath)
• Stochastic Differential Equations (Mastermath)
• Stochastic Integration (UvA)
• Stochastic Processes (Mastermath)

Advanced courses
• Bayesian Statistics (Mastermath)
• Data-Driven Decision Making in Operations Research (UvA)
• Queues and Levy Fluctuation Theory (UvA)
• Percolation: from Introduction to Frontiers of Current Research (Mastermath, not in 2018/2019)
• Statistical Theory for High- and Infinite-Dimensional Models (Mastermath)

Related courses
• Optimization of Business Processes (VU)
• Statistical Theory for High- and Infinite-Dimensional Models (UvA, not every year)

---

Suggested lines

Probability
• Basic: Asymptotic Statistics, Forensic Probability and Statistics, Measure Theoretic Probability
• Advanced: Percolation: from Introduction to Frontiers of Current Research (not in 2018/2019)
• Related: Functional Analysis, Stochastic Integration,
Statistics
- Basic: Applied Statistics, Asymptotic Statistics, Measure Theoretic Probability, Statistical Models,
- Advanced: Statistics for Networks (18/19), Bayesian Statistics

Financial Mathematics
- Basic: Measure Theoretic Probability, Stochastics Processes for Finance
- Advanced: Interest Rate Models, Portfolio Theory
- Related: Functional Analysis, Partial Differential Equations

Research staff in Stochastics

UvA
Arnoud den Boer, Sonja Cox, Daan Crommelin, Jan-Pieter Dorsman, Bert van Es, Asma Khedher, Chris Klaassen, Bas Kleijn, Michel Mandjes, Sindo Núñez Queija, Marjan Sjerps, Peter Spreij, Erik Winands, Harry van Zanten.

VU
René Bekker, Eduard Belitser, Rob van den Berg, Sandjai Bhulai, Federico Camia, Dennis Dobler, Elenna Dugundji, Rikkert Hindriks, Mathisca de Gunst, Wouter Kager, Ger Koole, Ronald Meester, Rob van der Mei, Klaas Slooten, Wessel van Wieringen.
Mathematics: Biomedical Mathematics Track

Program outline

- **6EC**: Master Seminar in Analysis and Dynamical Systems or Master Seminar in Stochastics (two semesters, year 1)
- **3EC**: Scientific Writing in English (year 1)
- **36EC**: Master Project Mathematics (year 2)
- **30EC**: Minor Biomedical Mathematics
- **36EC**: Mathematics courses, consisting of
  - Compulsory courses:
    - Statistical Models
    - Dynamical Systems
    - Mathematical Biology
  - Remainder (14EC): mathematics courses (all tracks)
- **9EC**: Free (must be master courses; can be math, literature, ...)

Minor Biomedical Mathematics

For this minor we suggest 5 life science courses (see below). The minor may also include an 18EC applied project for students who already followed the VU biomedical mathematics program in the bachelor. The minor of the Master may include at most 18EC of the bachelor courses currently in the “Biomedische Wiskunde” variant of the bachelor at the VU, for students who did not yet follow those courses. Specifically: Biochemie, Medische Fysiologie, Principles of Systems Biology, Introductie Medische Beeldbewerking.

Fall 2018

Master Seminar

- Master Seminar in Analysis and Dynamical Systems (@UvA) or Master Seminar in Stochastics (@UvA)

Suggested Mathematics courses

- Asymptotic Statistics (Mastermath)
- Dynamical Systems (Mastermath)
- Functional Analysis (Mastermath)
- Mathematical Biology (Not in 18/19)
- Introduction to Numerical Bifurcation Analysis of ODEs and maps (Mastermath, not every year)
- Partial Differential Equations (Mastermath)
- Statistical Models (VU)
- Statistics for Networks (VU, 18/19)
Suggested life science courses in the Minor Biomedical Mathematics
- From Molecule to Mind (VU, period 1)
- Algorithms in Sequence Analysis (VU, period 2)
- Mechanics and Thermodynamics in the Cell (VU, period 2)

---

Spring 2019

Master Seminar
- Master Seminar in Analysis and Dynamical Systems (@VU) or Master Seminar in Stochastics (@VU)

Suggested Mathematics courses
- Inverse Problems in Imaging (Mastermath)
- Nonlinear Waves (Mastermath)
- Stochastic Differential Equations (Mastermath)
- Stochastic Processes (Mastermath)

Suggested life science courses in the Minor Biomedical Mathematics
- Basic Models of Biological Networks (VU, period 4)
- Advanced Modeling in Systems Biology (VU, period 6)

---

Research staff in Mathematical Biology

VU
Jan Bouwe van den Berg, Frank Bruggeman, Mathisca de Gunst, Rikkert Hindriks, Joost Hulshof, Bob Planqué, Mark van de Wiel, Wessel van Wieringen.
Mathematics: Education Track

Program outline

- **24EC**: Master Project Mathematics (T, E track) (year 1)
- **24EC**: Mathematics courses, from the MasterMath and local program. This excludes the MasterMath teacher courses.
- **12EC**: Free (must be master courses, but may include the MasterMath teacher courses; can be math, literature, . . .)
- **60EC**: Teaching qualification (including internship)

Alternative program for students with an Education Minor (30EC obtained earlier in the Bachelor)

- **24EC**: Master Project Mathematics (T, E track) (year 2)
- **33EC**: Teaching qualification (reduced: didaktiek, praktijk en onderzoek)
- **24EC**: Mathematics courses from the MasterMath and local master program. This excludes the MasterMath teacher courses.
- **12EC**: Free (must be master courses, but may include the MasterMath teacher courses; can be math, literature, . . .)
Mathematics: Teachers Track

This track has a special entry requirement: HBO students from the “lerarenopleiding wiskunde” with a “tweedegraadsbevoegdheid” can enter this track after having followed a premaster program (consisting of a specific selection of 30EC of first year bachelor courses). In the Teacher track, they follow a lot of mandatory courses (42EC) and must reach the exit level of the Education track.

Program outline

- **24EC**: Master Project Mathematics (T, E track) (year 2)
- **30EC**: Teaching qualification (reduced, including internship)
- **66EC**: Mathematics courses, consisting of
  - Compulsory courses:
    - Complexe Analyse
    - Dynamische Systemen
    - Measure Theory
    - Numerical Methods
    - Statistical Data Analysis
    - Statistics
  - Remainder (30C): mathematics courses from the MasterMath and local master program. This excludes the MasterMath teacher courses.
Stochastics and Financial Mathematics

Program outline

- **3EC**: Master Seminar Stochastics and Financial Mathematics (year 1)
- **3EC**: Scientific Writing in English (year 1)
- **36EC**: Master Project SFM (year 2)
- **63EC**: Designated SFM courses from the list below, consisting of
  - Measure Theoretic Probability (Mastermath)
  - at least 2 Financial Mathematics courses, out of
    * Computational Finance (UvA master Computational Science)
    * Interest Rate Models (UvA)
    * Portfolio Theory (UvA)
    * Stochastics Processes for Finance (VU)
  - at least 2 advanced SFM courses
- **12EC**: Free (must be master courses; can be a designated SFM course, Math, literature, . . .)

Fall 2018

Master Seminar
- Master Seminar Stochastics and Financial Mathematics (UvA/VU)

Designated SFM courses
- Advanced Machine Learning (VU)
- Advanced Topics in Stochastic Analysis (UvA)
- Applied Stochastic Modelling (VU)
- Asymptotic Statistics (Mastermath)
- Forensic Probability and Statistics (Mastermath)
- Functional Analysis (Mastermath)
- Heuristic Methods in Operations Research (Mastermath)
- Interest Rate Models (UvA)
- Machine Learning Theory (Mastermath)
- Measure Theoretic Probability (Mastermath)
- Partial Differential Equations (Mastermath)
- Portfolio Theory (UvA)
- Probabilistic and Extremal Combinatorics (Mastermath)
- Simulation Methods in Statistics (UvA)
- Statistical Models (VU)
- Stochastic Optimization (VU)
- Stochastic Networks (UvA)
- Stochastics Processes for Finance (VU)
• Stochastic Simulation (UvA)

Advanced SFM courses
• Interest Rate Models (UvA)
• Portfolio Theory (UvA)
• Statistics for Networks (VU, 18/19)

Spring 2019

Designated SFM courses
• Applied Analysis: Financial Mathematics (VU)
• Applied Statistics (Mastermath)
• Bayesian Statistics (Mastermath)
• Computational Finance (UvA master Computational Science)
• Data-drive Decision Making in Operations Research (UvA)
• Entrepreneurship in Data Science and Analytics (VU)
• Optimization of Business Processes (VU)
• Percolation: from Introduction to Frontiers of Current Research (Mastermath, not in 2018/2019)
• Performance of Networked Systems (VU)
• Queuing Theory (Mastermath)
• Queues and Levy Fluctuation Theory (UvA)
• Stochastic Differential Equations (Mastermath)
• Statistical Theory for High- and Infinite-Dimensional Models (Mastermath)
• Statistics for Networks (VU)
• Stochastic Integration (UvA)
• Stochastic Processes (Mastermath)

Advanced SFM courses
• Percolation: from Introduction to Frontiers of Current Research (Mastermath, not in 2018/2019)

Research staff in SFM

UvA
Arnoud den Boer, Sonja Cox, Jan-Pieter Dorsman, Bert van Es, Asma Khedher, Chris Klaassen, Bas Kleijn, Michel Mandjes, Sindo Núñez Queija, Marjan Sjerps, Peter Spreij, Robin de Vilder, Erik Winands, Harry van Zanten.

VU
René Bekker, Eduard Belitser, Rob van den Berg, Sandjai Bhulai, Federico Camia, Dennis Dobler, Elena Dugundji, Rikker Hindriks, Mathisca de Gunst, Wouter Kager, Ger Koole, Ronald Meester, Rob van der Mei.
Final remarks

Free Masters

As prescribed in part A of the OER, students may apply to the Board of Examiners to do a “free master”, in which they are not bound to a track. This is not generally advised, unless there is a focus on some research area not represented in the tracks, such as mathematical logic or discrete mathematics. The criteria roughly are:

- **6EC**: One of the three Master Seminars
- **3EC**: Scientific Writing in English
- **36EC**: Master Project Mathematics
- **36EC**: A coherent selection of Master courses in Mathematics or logic, offered in Amsterdam or in Mastermath. At least two of these should be advanced Master courses. The meaning of “coherent” is to be decided by the Board of Examiners.
- **24EC**: Other mathematics courses offered locally and in MasterMath.
- **15EC**: Free (must be master level; can be math, literature, . . .)

Interdisciplinary Masters

The Biomedical Mathematics track is an example of an interdisciplinary track. If a student would like to combine mathematics with another discipline, then the Board of Examiners can approve such a program. The criteria roughly are:

- **6EC**: One of the three Master Seminars
- **3EC**: Scientific Writing in English
- **36EC**: Master Project Mathematics
- **30EC**: A Minor, consisting of a coherent selection of Master courses in a field that is (loosely) related to Mathematics. The meaning of “coherent” is to be decided the Board of Examiners.
- **36EC**: Mathematics courses offered locally or in MasterMath. At least two of these should be advanced Master courses.
- **9EC**: Free (must be master level; can be math, literature, . . .)

Other courses

Several courses that may be followed in the Master Mathematics or as elective courses in the Master SFM, do not fall explicitly under a track and hence were not mentioned in this document. For more details we refer to the online UvA and VU study guides, and the Mastermath website.
Appendix: list of courses

Fall 2018

VU Fall 2018
- Advanced Machine Learning
- Applied Stochastic Modelling
- Control of Infinite Dimensional Systems
- Statistical Models
- Stochastic Optimization
- Stochastics Processes for Finance

UvA Fall 2018
- Advanced Topics in Stochastic Analysis
- Interest Rate Models
- Portfolio Theory
- Quivers
- Simulation Methods in Statistics
- Stochastic Networks
- Stochastic Simulation
- Uncertainty Quantification and Data Assimilation

Mastermath Fall 2018
- Advanced Algebraic Geometry: Abelian Varieties
- Algebraic Geometry 1
- Algebraic Topology 1
- Algebraic Number Theory
- Analytic Number Theory
- Asymptotic Statistics
- Commutative Algebra
- Continuous Optimization
- Cryptology
- Differential Geometry
- Discrete Optimization
- Dynamical Systems
- Ergodic Theory
- Forensic Probability and Statistics
- Functional Analysis
- Heuristic Methods in Operations Research
- Interacting Particle Systems: Theory and Applications
- Machine Learning Theory
- Measure Theoretic Probability
- Numerical Linear Algebra
Appendix: list of courses

- p-Adic Numbers and Applications
- Parallel Algorithms
- Partial Differential Equations
- Probabilistic and Extremal Combinatorics
- Set Theory
- Symmetries and Conservation Laws of nonlinear PDE
- Systems and Control
- Topos Theory

Spring 2019

VU Spring 2019
- Applied Analysis: Financial Mathematics
- Coding and Cryptography
- Entrepreneurship in Data Science and Analytics
- Optimization of Business Processes
- Performance of Networked Systems
- Statistics for Networks

UvA Spring 2019
- Computational Complexity
- Data-drive Decision Making in Operations Research
- Mirror Symmetry
- Queues and Levy Fluctuation Theory
- Stochastic Integration
- Topics in Number Theory

Mastermath Spring 2019
- Additive Combinatorics
- Advanced Complex Analysis
- Algebraic Methods in Combinatorics
- Algebraic Geometry 2
- Algebraic Topology 2
- Algebraic Topology in Dynamical Systems
- Advanced Linear Programming
- Applied Finite Elements
- Applied Statistics
- Bayesian Statistics
- Coding Theory
- Elliptic Curves
- Geometric Functional Analysis and its Applications
- Geometric PDE
- History and Philosophy of Mathematics
- Inverse Problems in Imaging
- Lie Groups and Lie Algebras
 Appendix: list of courses

- Model Theory
- Multiple Zeta Functions
- Numerical Methods for Time Dependent PDEs
- Numerical Bifurcation Analysis of Large-scale Systems
- Operator Algebras
- Quantum Computing
- Quantum Information Theory
- Queueing Theory
- Riemann Surfaces
- Scheduling
- Selected Areas in Cryptology
- Stochastic Differential Equations
- Statistical Theory for High- and Infinite Dimensional Models
- Stochastic Processes
- Symplectic Geometry
- Topology in Physics

**UvA other semester for SFM**
- Computational Finance

**VU courses for Biomedical track**
- Mathematical Biology
- Algorithms in Sequence Analysis
- Mechanics and Thermodynamics in the Cell
- Neurogenomics
- Basic Models of Biological Networks
- Advanced Modeling in Systems Biology
- From Molecule to Mind

**Mastermath Lerarenvakken (for Education Track)**
- Stochastiek (najaar 2018)
- Meetkunde (najaar 2018)
- Geschiedenis (voorjaar 2019)
- Getaltheorie (voorjaar 2019)