



Mathematics MSc

Vrije Universiteit Amsterdam - Faculteit der Exacte Wetenschappen - M Mathematics - 2017-2018

The master programme Mathematics of the Vrije Universiteit Amsterdam offers students a wide range of advanced mathematics courses. The students have a variety of options to specialize in a (sub)field of fundamental or applied mathematics. They can also choose broader subjects with an eye towards applications or a profession.

Reflecting these possibilities, each student enrolls in one of the following six tracks:

- Algebra and Geometry (A&G)
- Analysis and Dynamical Systems (A&DS)
- Stochastics (S)
- Education (E)
- Teachers (T)
- Biomedical Mathematics (BM)

The A&G, A&DS and S tracks contain 9 EC compulsory courses (the master seminar and the course 'Scientific writing in English'), a number of track specific mandatory courses and at least two advanced courses. Students are allowed to choose at most 15 EC elective courses (possibly outside mathematics), choose mathematics master courses for the remaining creditpoints (under certain restrictions) and complete their studies with a master project (or internship) of 36 EC. The same applies to the BM track, but in this track there are at most 9 EC elective courses (possibly outside mathematics) and 30 EC of the courses are to be chosen from an area of life science.

The T track is designed for students with a 'HBO tweedegraads lesbevoegdheid wiskunde' who finished a premaster at the VU. The T track consists of 42 EC mandatory courses, 24 EC Mathematics master courses (under certain restrictions), 24 EC master project and 30 EC courses for the teaching qualification (including internship). The E track is aimed at students with a BSc Mathematics who want to obtain a 'eerstegraads lesbevoegdheid'. These students follow 12 EC elective courses (possibly outside mathematics), choose 24 EC mathematics master courses (under certain restrictions), do a master project of 24 EC, and complete their studies with 60 EC courses aimed at obtaining their teaching qualification. Details about the compulsory and elective courses in the different tracks can be found in the study guide.

At the start of every semester, students discuss their intended programme with the master coordinator. Mathematics courses can be selected from the 'local' courses offered by the Vrije Universiteit Amsterdam and the University of Amsterdam, but also from the MasterMath programme that is offered jointly by nine Dutch Universities.

The master project is carried out under the supervision of a staff member of the Vrije Universiteit Amsterdam or the University of Amsterdam. In case of an internship the student has both a local advisor at a company and a supervisor from one of the two institutes; please contact the internship office roughly half a year before the start of the internship. In the A&G, A&DS, S and BM tracks the student can only start the master project or internship after obtaining at least 75 EC.

More information

- All compulsory courses and electives you find in the [year schedule](#);
- A complete description of the programme you find in the [Teaching and Examination Regulations](#);
- For more information about the programme you can contact the [academic advisor](#) (VU students only);
- As a VU student you need to register for all courses via [VU.net](#). Only after you completed your enrollment for the study programme you can register for courses;
- More information on all the courses you find through the links below.

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M Mathematics Analysis and Dynamical Systems track

Compulsory courses for the Analysis and Dynamical Systems track are:

- Master Project Mathematics (36 EC)
- Master Seminar in Analysis and Dynamical Systems (6 EC)
- Scientific Writing in English (3 EC)

For the remaining 75 EC:

Students in the Analysis and Dynamical Systems Track must choose 3 core courses from the list below, and 2 advanced courses from the list below.

Besides these courses they may choose elective Mathematics courses from the Mastermath program (excluding the Mastermath teacher courses) or from the local VU and UvA programs (for these local courses, see the lists below). Some (nonbinding) suggestions are made in the list below. In addition they may choose 15 EC of electives outside of Mathematics.

Opleidingsdelen:

- [Compulsory Courses](#)
- [Compulsory Choice 2 out of 4 \(advanced courses Analysis and Dynamical Systems\)](#)
- [Suggested elective Courses \(MasterMath and Local courses\)](#)
- [Compulsory choice 3 out of 4](#)

Compulsory Courses

Vakken:

Naam	Periode	Credits	Code
Master Project Mathematics	Ac. Jaar (september)	36.0	X_400355
Master Seminar in Analysis and Dynamical Systems	Periode 1+2, Periode 4+5	6.0	XM_41013
Scientific Writing in English	Periode 4	3.0	X_400512

Compulsory Choice 2 out of 4 (advanced courses Analysis and Dynamical Systems)

• At least two advanced courses in A&DS: usually taken in the second year of the Master. These courses may change from year to year. In 2017-2018 they are:

Vakken:

Naam	Periode	Credits	Code
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Poisson Geometry	Periode 1+2	8.0	XMM_0011

Suggested elective Courses (MasterMath and Local courses)

Some (nonbinding) elective courses:

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001
Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002
Algebraic Methods in Combinatorics	Periode 4+5	8.0	XMM_40003
Algebraic Number Theory	Periode 1+2	8.0	X_400324
Algebraic Topology	Periode 1+2	8.0	X_400600
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Algorithmic Geometry of Numbers	Periode 4+5	8.0	XMM_0010
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Coding and Cryptography	Periode 4	6.0	X_405041
Coding Theory	Periode 4+5	8.0	X_418160
Commutative Algebra	Periode 1+2	8.0	X_418136
Complexity Theory		8.0	XMM_0006
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 4+5	8.0	X_418115
Cryptography	Periode 1+2	5.0	XMM_40006
Differential geometry	Periode 1+2	8.0	X_400509
Discrete Optimization	Periode 1+2	6.0	X_400445
Dynamical Systems	Periode 1+2	8.0	X_400429
Dynamics of Networks		6.0	XMM_0007
Elliptic Curves	Periode 4+5	8.0	X_400505
Forensic Probability and Statistics	Periode 1+2	8.0	XMM_0005
Foundations of General Relativity	Periode 4+5	8.0	XMM_0009
Functional Analysis	Periode 1+2	8.0	X_400328

Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
History and Philosophy of Mathematics	Periode 4+5	6.0	XMU_0005
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Inverse Problems in Imaging	Periode 4+5	8.0	XMM_0004
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Machine Learning Theory	Periode 1+2	8.0	XMM_0002
Mathematical Biology	Periode 1+2	8.0	X_400504
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Modular Forms	Periode 4+5	8.0	X_400599
Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Operator Algebras	Periode 4+5	8.0	X_418062
Optimization of Business Processes	Periode 4+5	6.0	X_400422
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 1+2	8.0	X_400330
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Poisson Geometry	Periode 1+2	8.0	XMM_0011
Portfolio Theory	Periode 1+2	6.0	X_400535
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Computing	Periode 4+5	8.0	XMM_0013
Quantum Groups and Integrable Systems	Periode 4+5	6.0	XMU_0004
Queueing Theory	Periode 4+5	6.0	X_400397
Queues and Levy Fluctuation Theory	Periode 4+5	6.0	XMU_0002
Quivers	Periode 1+2	6.0	XMU_0003
Riemann Surfaces	Periode 4+5	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Selected Areas in Cryptology	Periode 4+5	8.0	XMM_40011
Semidefinite Optimization	Periode 4+5	8.0	XMM_0015
Set Theory	Periode 1+2	8.0	X_418035
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Spatial Statistics	Periode 4+5	6.0	XMM_0001
Statistical Models	Periode 1+2	6.0	X_400418

Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008
Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes	Periode 4+5	8.0	X_400339
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Stochastic Simulation	Periode 1+2	6.0	XMU_0001
Systems and Control	Periode 1+2	6.0	X_400332
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Time series	Periode 4+5	8.0	X_400571
Topology in Physics	Periode 4+5	8.0	XMM_0003

Compulsary choice 3 out of 4

- At least three courses from the following list (in MasterMath):

Vakken:

Naam	Periode	Credits	Code
Dynamical Systems	Periode 1+2	8.0	X_400429
Functional Analysis	Periode 1+2	8.0	X_400328
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Partial Differential Equations	Periode 1+2	8.0	X_400330

M Mathematics Algebra and Geometry track

Compulsory courses for the Algebra and Geometry Track are:

- Master Project Mathematics (36 EC)
- Master Seminar in Algebra and Geometry (6 EC)
- Scientific Writing in English (3 EC)

For the remaining 75 EC:

Students in the Algebra and Geometry Track must choose 3 core courses from the list below, and 2 advanced courses from the list below. Besides these courses they may choose elective Mathematics courses from the Mastermath program (excluding the Mastermath teacher courses) or from the local VU and UvA programs (for these local courses, see the lists below). Also some (nonbinding) suggestions are made in the list below. In addition they may choose 15 EC of electives outside of Mathematics.

Opleidingsdelen:

- Compulsory Courses
- Suggested elective Courses (MasterMath and Local courses)
- Compulsory choice 2 out of 9 (advanced courses Algebra and Geometry)
- Compulsory Choice 3 out of 4 (MasterMath courses) 24 ec

Compulsory Courses

Compulsory Courses:

Vakken:

Naam	Periode	Credits	Code
Master Project Mathematics	Ac. Jaar (september)	36.0	X_400355
Master Seminar in Algebra and Geometry	Periode 1+2, Periode 4+5	6.0	XMU_41011
Scientific Writing in English	Periode 4	3.0	X_400512

Suggested elective Courses (MasterMath and Local courses)

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001
Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002
Algebraic Methods in Combinatorics	Periode 4+5	8.0	XMM_40003
Algebraic Number Theory	Periode 1+2	8.0	X_400324
Algebraic Topology	Periode 1+2	8.0	X_400600
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Algorithmic Geometry of Numbers	Periode 4+5	8.0	XMM_0010
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Coding and Cryptography	Periode 4	6.0	X_405041
Coding Theory	Periode 4+5	8.0	X_418160

Commutative Algebra	Periode 1+2	8.0	X_418136
Complexity Theory		8.0	XMM_0006
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 4+5	8.0	X_418115
Cryptology	Periode 1+2	5.0	XMM_40006
Differential geometry	Periode 1+2	8.0	X_400509
Discrete Optimization	Periode 1+2	6.0	X_400445
Dynamical Systems	Periode 1+2	8.0	X_400429
Dynamics of Networks		6.0	XMM_0007
Elliptic Curves	Periode 4+5	8.0	X_400505
Foundations of General Relativity	Periode 4+5	8.0	XMM_0009
Functional Analysis	Periode 1+2	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
History and Philosophy of Mathematics	Periode 4+5	6.0	XMU_0005
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Inverse Problems in Imaging	Periode 4+5	8.0	XMM_0004
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Machine Learning Theory	Periode 1+2	8.0	XMM_0002
Mathematical Biology	Periode 1+2	8.0	X_400504
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Modular Forms	Periode 4+5	8.0	X_400599
Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Operator Algebras	Periode 4+5	8.0	X_418062
Optimization of Business Processes	Periode 4+5	6.0	X_400422
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 1+2	8.0	X_400330
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Poisson Geometry	Periode 1+2	8.0	XMM_0011
Portfolio Theory	Periode 1+2	6.0	X_400535
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Groups and Integrable Systems	Periode 4+5	6.0	XMU_0004
Queueing Theory	Periode 4+5	6.0	X_400397
Queues and Levy Fluctuation Theory	Periode 4+5	6.0	XMU_0002
Quivers	Periode 1+2	6.0	XMU_0003

Riemann Surfaces	Periode 4+5	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Selected Areas in Cryptology	Periode 4+5	8.0	XMM_40011
Semidefinite Optimization	Periode 4+5	8.0	XMM_0015
Set Theory	Periode 1+2	8.0	X_418035
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Spatial Statistics	Periode 4+5	6.0	XMM_0001
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008
Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
Statistics for Networks		6.0	X_405110
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes	Periode 4+5	8.0	X_400339
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Stochastic Simulation	Periode 1+2	6.0	XMU_0001
Systems and Control	Periode 1+2	6.0	X_400332
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Time series	Periode 4+5	8.0	X_400571
Topology in Physics	Periode 4+5	8.0	XMM_0003

Compulsary choice 2 out of 9 (advanced courses Algebra and Geometry)

At least two advanced courses in A&G: usually taken in the second year of the Master. These courses may change from year to year. In 2017/18 these are

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Poisson Geometry	Periode 1+2	8.0	XMM_0011
TFT and moduli spaces	Periode 4+5	6.0	X_418073

Compulsory Choice 3 out of 4 (MasterMath courses) 24 ec

- At least three courses from the following list (in MasterMath):

Vakken:

Naam	Periode	Credits	Code
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001
Algebraic Topology	Periode 1+2	8.0	X_400600
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Riemann Surfaces	Periode 4+5	8.0	X_400325

M Mathematics Biomedical Mathematics track

Compulsory courses for the Biomedical Mathematics Track (61 EC):

- Master Project Mathematics (36 EC)
- Compulsory choice one out of two:
 - Master Seminar in Analysis and Dynamical Systems (6 EC)
 - Master Seminar in Stochastics (6 EC)
- Scientific Writing in English (3 EC)
- Dynamical Systems (8 EC)
- Statistical Models (6 EC)
- Mathematical Biology (8 EC, 2017/18)

For the remaining 59 EC:

- At least 30 EC courses in Life Sciences.
- At least 20 EC courses in Mathematics, from the Mastermath program or from the local VU or UvA programs.
- At most 9 EC of electives outside of Mathematics.

Opleidingsdelen:

- [Compulsory Choice](#)
- [Recommended Choice Life Science Courses \(30 EC\)](#)
- [Compulsory Choice 1 out of 2](#)
- [Compulsory Courses](#)

Compulsory Choice

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001

Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002
Algebraic Methods in Combinatorics	Periode 4+5	8.0	XMM_40003
Algebraic Number Theory	Periode 1+2	8.0	X_400324
Algebraic Topology	Periode 1+2	8.0	X_400600
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Algorithmic Geometry of Numbers	Periode 4+5	8.0	XMM_0010
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Coding and Cryptography	Periode 4	6.0	X_405041
Coding Theory	Periode 4+5	8.0	X_418160
Commutative Algebra	Periode 1+2	8.0	X_418136
Complexity Theory		8.0	XMM_0006
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 4+5	8.0	X_418115
Cryptology	Periode 1+2	5.0	XMM_40006
Differential geometry	Periode 1+2	8.0	X_400509
Discrete Optimization	Periode 1+2	6.0	X_400445
Dynamics of Networks		6.0	XMM_0007
Elliptic Curves	Periode 4+5	8.0	X_400505
Forensic Probability and Statistics	Periode 1+2	8.0	XMM_0005
Foundations of General Relativity	Periode 4+5	8.0	XMM_0009
Functional Analysis	Periode 1+2	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
History and Philosophy of Mathematics	Periode 4+5	6.0	XMU_0005
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Inverse Problems in Imaging	Periode 4+5	8.0	XMM_0004
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Machine Learning Theory	Periode 1+2	8.0	XMM_0002
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Modular Forms	Periode 4+5	8.0	X_400599
Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Numerical Linear Algebra	Periode 1+2	8.0	X_400329

Operator Algebras	Periode 4+5	8.0	X_418062
Optimization of Business Processes	Periode 4+5	6.0	X_400422
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 1+2	8.0	X_400330
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Poisson Geometry	Periode 1+2	8.0	XMM_0011
Portfolio Theory	Periode 1+2	6.0	X_400535
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Computing	Periode 4+5	8.0	XMM_0013
Quantum Groups and Integrable Systems	Periode 4+5	6.0	XMU_0004
Queueing Theory	Periode 4+5	6.0	X_400397
Queues and Levy Fluctuation Theory	Periode 4+5	6.0	XMU_0002
Quivers	Periode 1+2	6.0	XMU_0003
Riemann Surfaces	Periode 4+5	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Selected Areas in Cryptology	Periode 4+5	8.0	XMM_40011
Semidefinite Optimization	Periode 4+5	8.0	XMM_0015
Set Theory	Periode 1+2	8.0	X_418035
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Spatial Statistics	Periode 4+5	6.0	XMM_0001
Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes	Periode 4+5	8.0	X_400339
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Stochastic Simulation	Periode 1+2	6.0	XMU_0001
Systems and Control	Periode 1+2	6.0	X_400332
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Time series	Periode 4+5	8.0	X_400571
Topology in Physics	Periode 4+5	8.0	XMM_0003

Recommended Choice Life Science Courses (30 EC)

Vakken:

Naam	Periode	Credits	Code
Advanced modelling in Systems Biology	Periode 6	6.0	X_418155
Algorithms in Sequence Analysis	Periode 2	6.0	X_405050
Basic Models of Biological Networks	Periode 2	6.0	X_418154
Mechanics and Thermodynamics in the Cell	Periode 2	6.0	X_422589
Neurogenomics	Periode 3	6.0	AM_1007

Compulsory Choice 1 out of 2

Compulsory choice one out of two:

Vakken:

Naam	Periode	Credits	Code
Master Seminar in Analysis and Dynamical Systems	Periode 1+2, Periode 4+5	6.0	XM_41013
Master Seminar in Stochastics	Periode 1+2, Periode 4+5	6.0	XM_41011

Compulsory Courses

Compulsory courses:

Vakken:

Naam	Periode	Credits	Code
Dynamical Systems	Periode 1+2	8.0	X_400429
Master Project Mathematics	Ac. Jaar (september)	36.0	X_400355
Mathematical Biology	Periode 1+2	8.0	X_400504
Scientific Writing in English	Periode 4	3.0	X_400512
Statistical Models	Periode 1+2	6.0	X_400418

M Mathematics Education track

The education track consists of mathematical courses and of some central courses of interest and optional courses within the education profile.

The greater part of the course consists of work experience or a student placement at a secondary school. Furthermore, the programme contains several didactical components and a practice-based research project. The master's thesis consists of a literature survey on an aspect of mathematical theory.

Content:

- Master Project Mathematics (T,E-track) (24 EC)
- Master Leraar VHO Wiskunde (60 EC)
- Compulsory choice mathematics (24 EC)
- Elective courses (12 EC)

Opleidingsdelen:

- [LVHO Wiskunde, overgangsregeling](#)
- [Master Leraar VHO Wiskunde vanaf 2015](#)
- [Compulsory Choice \(24 EC\)](#)
- [Compulsory Course Mathematics](#)

LVHO Wiskunde, overgangsregeling

Master Leraar VHO Wiskunde vanaf 2015

Vakken:

Naam	Periode	Credits	Code
Didactiek 1	Periode 1	6.0	O_MLDIDAC_1
Didactiek 2	Periode 2+3	6.0	O_MLDIDAC_2
Didactiek 3	Periode 4+5+6	9.0	O_MLDIDAC_3
Peergroup fase 1	Periode 1+2+3	0.0	O_MLPEERGR_1
Peergroup Fase 2	Periode 3+4+5	0.0	O_MLPEERGR_2
Praktijk 1	Periode 1	6.0	O_MLPRAK_1
Praktijk 2	Periode 2+3	9.0	O_MLPRAK_2
Praktijk 3	Periode 4+5+6	15.0	O_MLPRAK_3
Praktijk 3 voor 2-jarige Master		15.0	O_M2PRAK3
Praktijkonderzoek 1	Periode 3	3.0	O_MLPROZ_1
Praktijkonderzoek 2	Periode 4+5+6	6.0	O_MLPROZ_2

Compulsory Choice (24 EC)

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001

Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002
Algebraic Methods in Combinatorics	Periode 4+5	8.0	XMM_40003
Algebraic Number Theory	Periode 1+2	8.0	X_400324
Algebraic Topology	Periode 1+2	8.0	X_400600
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Algorithmic Geometry of Numbers	Periode 4+5	8.0	XMM_0010
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Coding and Cryptography	Periode 4	6.0	X_405041
Coding Theory	Periode 4+5	8.0	X_418160
Commutative Algebra	Periode 1+2	8.0	X_418136
Complexity Theory		8.0	XMM_0006
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 4+5	8.0	X_418115
Cryptology	Periode 1+2	5.0	XMM_40006
Differential geometry	Periode 1+2	8.0	X_400509
Discrete Optimization	Periode 1+2	6.0	X_400445
Dynamical Systems	Periode 1+2	8.0	X_400429
Dynamics of Networks		6.0	XMM_0007
Elliptic Curves	Periode 4+5	8.0	X_400505
Forensic Probability and Statistics	Periode 1+2	8.0	XMM_0005
Foundations of General Relativity	Periode 4+5	8.0	XMM_0009
Functional Analysis	Periode 1+2	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
History and Philosophy of Mathematics	Periode 4+5	6.0	XMU_0005
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Inverse Problems in Imaging	Periode 4+5	8.0	XMM_0004
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Machine Learning Theory	Periode 1+2	8.0	XMM_0002
Mathematical Biology	Periode 1+2	8.0	X_400504
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Modular Forms	Periode 4+5	8.0	X_400599

Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Operator Algebras	Periode 4+5	8.0	X_418062
Optimization of Business Processes	Periode 4+5	6.0	X_400422
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 1+2	8.0	X_400330
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Poisson Geometry	Periode 1+2	8.0	XMM_0011
Portfolio Theory	Periode 1+2	6.0	X_400535
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Computing	Periode 4+5	8.0	XMM_0013
Quantum Groups and Integrable Systems	Periode 4+5	6.0	XMU_0004
Queueing Theory	Periode 4+5	6.0	X_400397
Queues and Levy Fluctuation Theory	Periode 4+5	6.0	XMU_0002
Quivers	Periode 1+2	6.0	XMU_0003
Riemann Surfaces	Periode 4+5	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Selected Areas in Cryptology	Periode 4+5	8.0	XMM_40011
Semidefinite Optimization	Periode 4+5	8.0	XMM_0015
Set Theory	Periode 1+2	8.0	X_418035
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Spatial Statistics	Periode 4+5	6.0	XMM_0001
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008
Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes	Periode 4+5	8.0	X_400339
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Stochastic Simulation	Periode 1+2	6.0	XMU_0001
Systems and Control	Periode 1+2	6.0	X_400332
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Time series	Periode 4+5	8.0	X_400571

Topology in Physics	Periode 4+5	8.0	XMM_0003
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Compulsory Course Mathematics

Vakken:

Naam	Periode	Credits	Code
Master Project Mathematics (T,E track)	Ac. Jaar (september)	24.0	X_405037

M Mathematics Stochastics track

Compulsory courses for the Stochastics Track (69 EC):

- Master Project Mathematics (36 EC)
- Asymptotic Statistics (8 EC)
- Measure Theoretic Probability (8 EC)
- Stochastic Processes (8 EC)
- Master Seminar in Stochastics (6 EC)
- Scientific Writing in English (3 EC)

For the remaining 51 EC:

Students in the Stochastics Track must choose 2 advanced courses from the list below. Besides these courses they may choose elective Mathematics courses from the Mastermath program (excluding the Mastermath teacher courses) or from the local VU and UvA programs (for these local courses, see the lists below). Some (nonbinding) suggestions are made in the list below. In addition they may choose 15 EC of electives outside of Mathematics.

Opleidingsdelen:

- [Suggested elective Courses \(24 elective ec\)](#)
- [Compulsory Choice 2 out of 8 Advanced Courses Stochastics](#)
- [Compulsory Courses](#)

Suggested elective Courses (24 elective ec)

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001
Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002

Algebraic Methods in Combinatorics	Periode 4+5	8.0	XMM_40003
Algebraic Number Theory	Periode 1+2	8.0	X_400324
Algebraic Topology	Periode 1+2	8.0	X_400600
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Algorithmic Geometry of Numbers	Periode 4+5	8.0	XMM_0010
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Coding and Cryptography	Periode 4	6.0	X_405041
Coding Theory	Periode 4+5	8.0	X_418160
Commutative Algebra	Periode 1+2	8.0	X_418136
Complexity Theory		8.0	XMM_0006
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 4+5	8.0	X_418115
Cryptology	Periode 1+2	5.0	XMM_40006
Differential geometry	Periode 1+2	8.0	X_400509
Discrete Optimization	Periode 1+2	6.0	X_400445
Dynamical Systems	Periode 1+2	8.0	X_400429
Dynamics of Networks		6.0	XMM_0007
Elliptic Curves	Periode 4+5	8.0	X_400505
Forensic Probability and Statistics	Periode 1+2	8.0	XMM_0005
Foundations of General Relativity	Periode 4+5	8.0	XMM_0009
Functional Analysis	Periode 1+2	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
History and Philosophy of Mathematics	Periode 4+5	6.0	XMU_0005
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Machine Learning Theory	Periode 1+2	8.0	XMM_0002
Mathematical Biology	Periode 1+2	8.0	X_400504
Modular Forms	Periode 4+5	8.0	X_400599
Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Operator Algebras	Periode 4+5	8.0	X_418062
Optimization of Business Processes	Periode 4+5	6.0	X_400422

Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 1+2	8.0	X_400330
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Poisson Geometry	Periode 1+2	8.0	XMM_0011
Portfolio Theory	Periode 1+2	6.0	X_400535
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Computing	Periode 4+5	8.0	XMM_0013
Quantum Groups and Integrable Systems	Periode 4+5	6.0	XMU_0004
Queueing Theory	Periode 4+5	6.0	X_400397
Queues and Levy Fluctuation Theory	Periode 4+5	6.0	XMU_0002
Quivers	Periode 1+2	6.0	XMU_0003
Riemann Surfaces	Periode 4+5	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Selected Areas in Cryptology	Periode 4+5	8.0	XMM_40011
Semidefinite Optimization	Periode 4+5	8.0	XMM_0015
Set Theory	Periode 1+2	8.0	X_418035
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Spatial Statistics	Periode 4+5	6.0	XMM_0001
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008
Statistics for Networks		6.0	X_405110
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Stochastic Simulation	Periode 1+2	6.0	XMU_0001
Systems and Control	Periode 1+2	6.0	X_400332
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Time series	Periode 4+5	8.0	X_400571
Topology in Physics	Periode 4+5	8.0	XMM_0003

Compulsory Choice 2 out of 8 Advanced Courses Stochastics

Compulsory Choice 2 out of 7:

Vakken:

Naam	Periode	Credits	Code
Interest Rate Models	Periode 1+2	6.0	X_418091
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Portfolio Theory	Periode 1+2	6.0	X_400535
Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008
Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
Statistics for Networks		6.0	X_405110

Compulsory Courses

Vakken:

Naam	Periode	Credits	Code
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Master Project Mathematics	Ac. Jaar (september)	36.0	X_400355
Master Seminar in Stochastics	Periode 1+2, Periode 4+5	6.0	XM_41011
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Scientific Writing in English	Periode 4	3.0	X_400512
Stochastic Processes	Periode 4+5	8.0	X_400339

M Mathematics Teachers track

Samenstelling programma Teachers-Track:

- 60 EC lerarenopleiding (in de regel wordt 30 EC vrijgesteld, tenzij de 2e graads bevoegdheid meer dan 6 jaar geleden behaald is en in de tussentijd geen onderwijservaring is opgedaan)
- 24 EC uit lijst Wiskunde (XM_MAT_T_K)
- 24 EC masterscriptie
- 42 EC verplichte vakken, zie onderstaande tabel (XM_MAT_T_V1)

Opleidingsdelen:

- [Compulsory Choice](#)
- [Compulsory Courses](#)

Compulsory Choice

Compulsory Choice Mathematics (24 EC required):

Vakken:

Naam	Periode	Credits	Code
Advanced Algebraic Geometry	Periode 1+2	8.0	X_418083
Advanced Combinatorics	Periode 1+2	8.0	X_418135
Advanced Hamiltonian Dynamics	Periode 1+2	8.0	XMM_0016
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Algebraic Geometry 1	Periode 1+2	8.0	XMM_40001
Algebraic Geometry 2	Periode 4+5	8.0	XMM_40002
Algebraic Methods in Combinatorics	Periode 4+5	8.0	XMM_40003
Algebraic Number Theory	Periode 1+2	8.0	X_400324
Algebraic Topology	Periode 1+2	8.0	X_400600
Algebraic Topology 2	Periode 4+5	8.0	XMM_0017
Algorithmic Geometry of Numbers	Periode 4+5	8.0	XMM_0010
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Coding and Cryptography	Periode 4	6.0	X_405041
Coding Theory	Periode 4+5	8.0	X_418160
Commutative Algebra	Periode 1+2	8.0	X_418136
Complexity Theory		8.0	XMM_0006
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 4+5	8.0	X_418115
Cryptology	Periode 1+2	5.0	XMM_40006
Differential geometry	Periode 1+2	8.0	X_400509
Discrete Optimization	Periode 1+2	6.0	X_400445
Dynamical Systems	Periode 1+2	8.0	X_400429
Dynamics of Networks		6.0	XMM_0007
Elliptic Curves	Periode 4+5	8.0	X_400505
Forensic Probability and Statistics	Periode 1+2	8.0	XMM_0005
Foundations of General Relativity	Periode 4+5	8.0	XMM_0009
Functional Analysis	Periode 1+2	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
History and Philosophy of Mathematics	Periode 4+5	6.0	XMU_0005

Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODEs and Maps	Periode 4+5	8.0	XMM_0018
Inverse Problems in Imaging	Periode 4+5	8.0	XMM_0004
Lie Groups and Lie Algebras	Periode 4+5	8.0	XMM_40008
Machine Learning Theory	Periode 1+2	8.0	XMM_0002
Mathematical Biology	Periode 1+2	8.0	X_400504
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Modular Forms	Periode 4+5	8.0	X_400599
Nonlinear Waves	Periode 4+5	8.0	XMM_40010
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Operator Algebras	Periode 4+5	8.0	X_418062
Optimization of Business Processes	Periode 4+5	6.0	X_400422
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 1+2	8.0	X_400330
Percolation: from Introduction to Frontiers of Current Research	Periode 4+5	8.0	XMM_0012
Poisson Geometry	Periode 1+2	8.0	XMM_0011
Portfolio Theory	Periode 1+2	6.0	X_400535
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Computing	Periode 4+5	8.0	XMM_0013
Quantum Groups and Integrable Systems	Periode 4+5	6.0	XMU_0004
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Queueing Theory	Periode 4+5	6.0	X_400397
Queues and Levy Fluctuation Theory	Periode 4+5	6.0	XMU_0002
Quivers	Periode 1+2	6.0	XMU_0003
Riemann Surfaces	Periode 4+5	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Selected Areas in Cryptology	Periode 4+5	8.0	XMM_40011
Semidefinite Optimization	Periode 4+5	8.0	XMM_0015
Set Theory	Periode 1+2	8.0	X_418035
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Spatial Statistics	Periode 4+5	6.0	XMM_0001
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
Statistical Theory for High- and Infinite-Dimensional Statistics	Periode 4+5	8.0	XMM_0008

Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Integration	Periode 4+5	8.0	X_400470
Stochastic Optimization	Periode 1+2	6.0	X_400336
Stochastic Processes	Periode 4+5	8.0	X_400339
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Stochastic Simulation	Periode 1+2	6.0	XMU_0001
Systems and Control	Periode 1+2	6.0	X_400332
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Time series	Periode 4+5	8.0	X_400571

Compulsory Courses

Vakken:

Naam	Periode	Credits	Code
Analysis 3	Periode 1+2	6.0	X_400627
Complexe Analyse	Periode 4+5	6.0	X_400386
Dynamische Systemen	Periode 1+2	6.0	X_400637
Master Project Mathematics (T,E track)	Ac. Jaar (september)	24.0	X_405037
Measure Theory	Periode 1+2	6.0	X_401028
Numerical Methods	Periode 4+5	6.0	X_401039
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistics	Periode 1+2	6.0	X_400004

Advanced Algebraic Geometry

Vakcode	X_418083 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

Doelgroep

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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Advanced Combinatorics

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

Inhoud vak

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

Doelgroep

mMath

Intekenprocedure

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Advanced Hamiltonian Dynamics

Vakcode	XMM_0016 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

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Advanced Linear Programming

Vakcode	X_400326 (400326)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. L. Stougie
Examinator	prof. dr. L. Stougie
Docent(en)	prof. dr. L. Stougie
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

This course is part of the joint national master programme in mathematics. For schedules, course locations and course descriptions see <https://elo.mastermath.nl/?lang=en>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Advanced modelling in Systems Biology

Vakcode	X_418155 ()
Periode	Periode 6
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. F.J. Bruggeman
Examinator	prof. dr. F.J. Bruggeman
Docent(en)	prof. dr. F.J. Bruggeman
Lesmethode(n)	Hoorcollege, Computerpracticum, Werkcollege
Niveau	500

Doel vak

To extend modelling techniques learnt in Basic models of biological networks and to get acquainted with more advanced aspects of modelling biological systems

Inhoud vak

In this course we will assume knowledge of Basic models of biological networks. We will go deeper into important issues in modelling biological systems. Issues that will be discussed are model validation (parameter estimation, experimental design), dynamic behaviour (instability, multistability), robustness and sensitivity analysis, more advanced Metabolic Control Analysis and stochastic modelling. After this course, students should be able to make a model, evaluate its dynamic behaviour and explore the structure and parameters of the model. This should provide enough background for students to apply modelling in their own research.

Onderwijsvorm

Lectures, self-study, computer practical work, computer modelling tutorials

Toetsvorm

Results of computer assignments, written exams

Literatuur

A course syllabus with recent reviews and papers presented by the lecturers and guest researchers (max. 15 euros)

Algebraic Geometry 1

Vakcode	XMM_40001 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>. Registration required via <https://elo.mastermath.nl/login/>

Doelgroep

mMath

Intekenprocedure

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

Algebraic Geometry 2

Vakcode	XMM_40002 ()
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Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

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

Algebraic Methods in Combinatorics

Vakcode	XMM_40003 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

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Algebraic Number Theory

Vakcode	X_400324 ()
Periode	Periode 1+2
Credits	8.0

Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

Doelgroep

mMath

Intekenprocedure

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Algebraic Topology

Vakcode	X_400600 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Inhoud vak

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

Doelgroep

mMath

Intekenprocedure

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Algebraic Topology 2

Vakcode	XMM_0017 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

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Algorithmic Geometry of Numbers

Vakcode	XMM_0010 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

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

Algorithms in Sequence Analysis

Vakcode	X_405050 (405050)
Periode	Periode 2
Credits	6.0

Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Heringa
Examinator	prof. dr. J. Heringa
Docent(en)	prof. dr. J. Heringa
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

Have you ever wondered how we can track a gene across 3 billion years of evolution? Sequence alignment can be used to compare genes from humans and bacteria, using a dynamic programming algorithm. In this course we focus on algorithms for biological sequences that can be applied to real scientific problems in biology.

Students will obtain in-depth knowledge about the theory of sequence analysis methods. They will also develop understanding and skills to apply the algorithms to protein and DNA sequences. We would like to stress that no biological knowledge is required to enter this course.

Goals

- At the end of the course, the student will be aware of the major issues, methodology and available algorithms in sequence analysis.
- At the end of the course, the student will have hands-on experience in tackling biological problems using sequence analysis algorithms and applying the general statistical framework of Hidden Markov Models.
- At the end of the course, the student will be able to implement several of the most important algorithms in sequence analysis.

Inhoud vak

Theory:

- Dynamic programming, database searching, pairwise and multiple alignment, probabilistic methods including hidden markov models, pattern matching, entropy measures, evolutionary models, and phylogeny.

Practical:

- Programming (in Python) own alignment algorithm based on dynamic programming
- Reverse translation and dynamic programming
- Homology searching and pattern recognition using biological and disease examples
- Multiple alignment of biological sequences
- Entropy-based functional residues prediction
- Programming (in Python) own implementation of Hidden Markov Models and using it to predict protein domain structure

Onderwijsvorm

13 Lectures: 2 two-hour lectures per week

13 Computer practicals and associated assignments: 2 two-hour hands-on sessions per week

Toetsvorm

The final grade for this course will consist of 50% practical work (see above) and 50% theoretical assessment.

The theoretical assessment will be an oral and/or written exam (depending on number of students).

Literatuur

Course material on bb.vu.nl

Books: Durbin, R., Eddy, S.R., Krogh, A., Mitchison, G.. Biological Sequence Analysis. Cambridge University Press, 1998, 350 pp., ISBN 0521629713.

Recommended reading: Marketa Zvelebil and Jeremy O. Baum Understanding Bioinformatics Garland Science 2008 ISBN-10: 0-8153-4024-9

Vereiste voorkennis

Bachelor in any science discipline (including medicine).

Basic programming skills (Python) and an interest in biological problems.

Doelgroep

mAI, mBio, mCS

Overige informatie

Signing up via bb.vu.nl is mandatory.

The course is taught in English.

Analysis 3

Vakcode	X_400627 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Hulshof
Examinator	prof. dr. J. Hulshof
Docent(en)	drs. W.A. Hetebrij
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

Verwerven van verdere kennis en vaardigheden op het gebied van de analyse.

Inhoud vak

Metrische ruimten, inverse en impliciete functiestelling
differentiaalvormen, stelling van Stokes

Onderwijsvorm

Hoor- en werkcolleges, huiswerk

Toetsvorm

2 schriftelijke deeltentamen of een mondeling tentamen (75%),
inleveropdrachten (25%)

Literatuur

C. H. Edwards, Advanced Calculus of Several Variables (Dover Books on Mathematics)

F. H. Croom, Principles of Topology,

Aanbevolen voorkennis

Analyse 2A en 2B

Doelgroep

2W, 2W-B

Intekenprocedure

via VUnet

Overige informatie

Voortzetting van Analyse 2A en 2B

Applied Analysis: Financial Mathematics

Vakcode	X_400076 (400076)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Examinator	prof. dr. A.C.M. Ran
Docent(en)	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The course aims to introduce the student to several aspects of the mathematical theory of option pricing.

Inhoud vak

This course gives an introduction to financial mathematics.

The following subjects will be treated:

- introduction in the theory of options;
- the binomial method;
- introduction to partial differential equations;
- the heat equation;
- the Black-Scholes formula and applications;
- introduction to numerical methods, approximating the price of an (American) option.

Onderwijsvorm

Lectures, exercises, discussion of exercises.

Toetsvorm

Homework exercises and final examination

Literatuur

The Mathematics of Financial Derivatives, A Student Introduction, by Paul Wilmott, Sam Howison, Jeff Dewynne. Cambridge University Press.

In addition, lecture notes will be made available for several topics which are not treated in the book.

Aanbevolen voorkennis
Calculus and Linear Algebra

Doelgroep
3W, mMath, mBA, 3Ect

Applied Finite Elements

Vakcode	X_400453 (400453)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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Doelgroep
mMath

Intekenprocedure

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Applied Stochastic Modeling

Vakcode	X_400392 (400392)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Bekker
Examinator	dr. R. Bekker
Docent(en)	dr. R. Bekker
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

During this course you will get acquainted with the most often used stochastic models and how they are applied in practice. The emphasis is on the variety of stochastic models (and their analysis) that appear in practice, rather than an in-depth study of a single-class of models.

During the course you learn to handle such practically motivated problems as an independent researcher; this means that you:

- learn to determine the appropriate model
- are able to formulate the problem mathematically correct
- are able to solve the stochastic model
- know how to interpret the outcome.

Inhoud vak

This course deals with a number of stochastic modeling techniques that are often used in practice. They are motivated by showing the business context in which they are used. Topics we deal with are: time-dependent Poisson processes and infinite-server queues, renewal processes and simulation, birth-death-processes, basic queueing models, and inventory models. We also repeat and extend certain parts of probability theory.

Onderwijsvorm

Lecture and instruction.

Toetsvorm

Written examination and two hand-in assignments (one in each period).

Literatuur

Lecture notes of Ger Koole (made available via Canvas).

Recommended: H.C. Tijms, A First Course in Stochastic Models, 2003. This is available as e-book via the VU library (ubvu), free of charge.

Additional material will be announced in due time.

Aanbevolen voorkennis

Probability theory, Poisson process, Markov chains in continuous time

Doelgroep

mBA, mMath

Asymptotic Statistics

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

Inhoud vak

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<https://elo.mastermath.nl>. Registration is required via

<https://elo.mastermath.nl/login>

Doelgroep

mMath

Intekenprocedure

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Basic Models of Biological Networks

Vakcode	X_418154 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. F.J. Bruggeman
Examinator	prof. dr. F.J. Bruggeman
Docent(en)	dr. J.P. Bruggeman, prof. dr. F.J. Bruggeman
Lesmethode(n)	Hoorcollege, Werkcollege, Computerpracticum
Niveau	400

Doel vak

The aim of the course is to learn the basis of modelling of biological systems. Computer models of metabolic networks, signal transduction pathways and transcriptional regulation are becoming indispensable in modern (medical) biology. After this course, students have an understanding of the principles of modelling, have learned to work with modelling tools and have applied these tools to biological examples. This should provide enough background for students to communicate with modellers or read modelling papers.

Inhoud vak

In this course we will teach how to set up computer models of biological systems, and how such models can be programmed in common software tools. We will provide some basic theoretical concepts required for understanding how to make models and how to interpret the results. Topics will include: properties of cell components (such as enzyme kinetics), mass and energy balances, stoichiometry and constraint-based modelling, kinetic modelling, Metabolic Control Analysis, modelling software. Topics will be illustrated by computer practicals of biological examples.

Onderwijsvorm

Lectures, self-study, computer practical work, computer modelling tutorials

Toetsvorm

Results of computer assignments, written exams.

Literatuur

A course syllabus with recent reviews and papers presented by the lecturers and guest researchers (max. 15 euros).

Category Theory and Topos Theory

Vakcode	X_418114 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	400

Inhoud vak

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

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

Doelgroep

mMATH

Intekenprocedure

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

Coding and Cryptography

Vakcode	X_405041 (405041)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.M.H. de Jeu
Examinator	prof. dr. R.M.H. de Jeu
Docent(en)	prof. dr. R.M.H. de Jeu
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak

The goal of the course is to give an elaborate introduction to the theory of error correcting codes, and to discuss some algebraic background of cryptography. After taking this course, the student:

- * will know the definitions of basic notions in error correcting codes (Hamming distance, error detecting/correcting capability);
- * will be able to decode certain 2-error correcting BCH-codes;
- * will be able to perform calculations in Galois fields with 2^n elements;
- * will be able to decode Reed-Solomon codes over such Galois fields;
- * will be able to decrypt messages encrypted under some public key cryptography (RSA, ElGamal).

Inhoud vak

This course provides a thorough introduction to the theory of error correcting codes, and also, as a small part of it, treats the algebraic background of some protocols in cryptography. It is aimed especially at students of Computer Science. For error correcting codes we shall include cyclic codes, BCH codes, Reed-Solomon codes and burst error correction. These are used in the error correcting codes underlying, for example, CD-ROM, audio CD, and QR-codes. For the small part

on cryptography we discuss some modern public key cryptography (e.g., RSA, ElGamal, DSA), which form part of the protocol underlying https.

Onderwijsvorm

Lectures and exercise classes

Toetsvorm

Written exam and homework. The written exam will count for 80 percent of the grade, the homework will count for 20 percent of the grade. If not both the written exam and the homework are at least 55 percent each, then the maximum score will be 54 percent (which constitutes a fail).

Literatuur

We shall be working from "Coding theory and cryptography, the essentials" by Hankerson, Hoffman, Leonard, Lindner, Phelps, Rodger and Wall (second edition, revised and expanded).

Aanbevolen voorkennis

Some knowledge on linear algebra (vectors, matrices, nullspaces, basis, dimension, some determinants), on the integers modulo n , and on polynomials. Although these will be reviewed, experience shows that the course is difficult to follow without having seen this material before.

Doelgroep

XM_CS 1, XM_PDCS 1, XM_MAT_B 1, XM_MAT_E 1, XM_MAT_T 1, XM_MAT_S 1, XM_MAT_ADS 1, XM_MAT_AG 1

Coding Theory

Vakcode	X_418160 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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

Commutative Algebra

Vakcode	X_418136 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.M.H. de Jeu
Examinator	prof. dr. R.M.H. de Jeu
Docent(en)	prof. dr. R.M.H. de Jeu
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course through

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

Registration is mandatory, as it is necessary for transferring your grade from Mastermath to the administration of your university.

Complexe Analyse

Vakcode	X_400386 (400386)
Periode	Periode 4+5
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. O. Fabert
Examinator	dr. O. Fabert
Docent(en)	dr. O. Fabert
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

De cursus beoogt enerzijds een inleiding te geven in de theoretische grondslagen van de complexe analyse en anderzijds vaardigheid te verschaffen in het oplossen van vraagstukken zoals het berekenen van integralen en het sommeren van reeksen.

Inhoud vak

Tijdens het college worden de volgende onderwerpen behandeld:

- complex differentieren en Cauchy-Riemann differentiaalvergelijkingen
- complexe integratie en de stelling en integraalformule van Cauchy
- elementaire eigenschappen van analytische functies

- singulariteiten, Laurent-ontwikkeling, residuenstelling
- toepassingen op gewone integralen

Onderwijsvorm

Hoorcollege en werkcollege.

Toetsvorm

Twee schriftelijke deeltentamens (40% + 60%, aan het einde van perioden 4 en 5)

Literatuur

Churchill, R. V., & Brown, J. W.: Complex variables and applications. Ninth edition, 2014, McGraw-Hill Book Co., New York

Aanbevolen voorkennis

Analyse 1A+B, Lineaire Algebra 1

Doelgroep

2W

Complexity Theory

Vakcode	XMM_0006 ()
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/>

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Continuous Optimization

Vakcode	X_400446 (400446)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Bekker
Examinator	dr. R. Bekker

Niveau	400
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Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl/>

Doelgroep

mMath; mBA

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login>

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

Continuum Mechanics

Vakcode	X_418115 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

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

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

Doelgroep

mMath

Intekenprocedure

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

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

Cryptology

Vakcode	XMM_40006 ()
Periode	Periode 1+2
Credits	5.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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

Didactiek 1

Vakcode	O_MLDIDAC_1 ()
Periode	Periode 1
Credits	6.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	C.L. Geraedts
Examinator	C.L. Geraedts
Docent(en)	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, dr. B. de Vries, drs. A.J.C. Monquil, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort, F.L. de Vries, drs. J. Quartel MA
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak

De cursus Didactiek 1 is onderdeel van de eerste fase (fase I) van de Universitaire Lerarenopleiding (ULO) van de VU, en loopt parallel aan de cursus Praktijk 1. De cursus is breed van opzet en omvat verschillende onderdelen die in samenhang worden aangeboden: algemene didactiek (AD), vakdidactiek (VD) en peergroup (PG).

Aan het eind van de cursus heeft de student de nodige basale algemeen didactische en vakdidactische bagage aan te reiken die nodig is voor het handelen als docent in simpele en overzichtelijke situaties op niveau van één les. Hierbij wordt nadrukkelijk aangesloten bij de ontwikkelingsfase waarin de docent-in-opleiding (dio) zich bevindt (zie inhoud).

Inhoud vak

De cursus is geordend rondom zogeheten kernpraktijken die fundamenteel zijn voor het beroep van docent. Bij Didactiek 1 staan de volgende

kernpraktijken centraal: (1) contact maken, (2) de les starten, (3) krediet opbouwen en uitgeven, (4) de les voorbereiden, (5) sturen en corrigeren en (6) volledige instructie geven en de les afsluiten. De reikwijdte van het didactisch denken en handelen is in deze eerste fase meestal nog beperkt tot één les. De genoemde kernpraktijken komen expliciet aan de orde bij AD. Bij VD wordt aangesloten bij deze kernpraktijken en wordt de vertaalslag gemaakt naar het eigen (school)vak. Daarnaast worden bij VD belangrijke vakdidactische concepten en werkwijzen geïntroduceerd

Bij PG staat de eigen onderwijspraktijk van de docent-in-opleiding (dio) centraal. Concrete vragen en situaties uit de praktijk vormen aanleiding tot analyse en reflectie. Waar bij AD en VD de nadruk ligt op de rollen van de uitvoerende en ontwerpende docent en pedagoog, wordt bij PG nadrukkelijk vorm gegeven aan de rol van onderzoekende professional.

De ervaring leert dat de kernpraktijken die bij Didactiek 1 centraal staan bij de meeste dio's uitgebreid aan de orde komen tijdens het eerste deel van de praktijkstage (Praktijk 1). Alle inhoudscomponenten uit deze cursus worden tijdens de bijeenkomsten en in verwerking verbonden met de werkplekpraktijk van de student. De dio en de werkplekbegeleider krijgen ook suggesties voor (observatie)opdrachten die kunnen bijdragen aan de ontwikkeling van de competenties die bij deze kernpraktijken horen.

Onderwijsvorm

Alle onderwijs vindt plaats op de instituutsdag (maandag). Studenten zijn de hele dag aanwezig. In de ochtend is er een hoor/werkcollege AD, waarbij dio's van verschillende vakken samen zitten. De colleges AD worden steeds verzorgd door een tweetal docenten. In de middag is er een werkcollege VD onder begeleiding van de vakdidacticus. Deze colleges worden samen met dio's van hetzelfde vak in verschillende samenstellingen (homogeen en heterogeen) gevolgd.

Tenslotte zijn er, verspreid over de periode, drie PG bijeenkomsten, waarbij dio's van verschillende vakken in kleine groepen en onder begeleiding de eigen onderwijspraktijk onder de loep nemen en eventuele concerns daarbij bespreken.

Bij alle onderdelen (AD, VD en PG) wordt een actieve houding van de student gevraagd, zowel tijdens de bijeenkomsten als daarbuiten. Regelmatig worden er verwerkingsopdrachten gegeven, waar individueel of in groepsverband aan wordt gewerkt. Deze opdrachten worden formatief geëvalueerd, onder andere door middel van (peer)feedback.

Toetsvorm

Didactiek 1 wordt afgesloten met een startproef waarin de studenten demonstreren dat zij één les kunnen ontwerpen en uitvoeren en kunnen reflecteren op de manier waarop voorbereiding, uitvoering en afronding hebben plaatsgevonden. De proef bestaat uit een lesontwerp (incl. verantwoording op basis van theorie, en eigen leerdoelen bij deze les), een videocompilatie (15 min.) van de gegeven les en een terugblik op de les. Bij het ontwerpen en uitvoeren van de les staan de kernpraktijken behandeld in de colleges algemene didactiek en vakdidactiek centraal (met een focus op de les en de leerling). De terugblik op ontwerp en uitvoering vindt plaats aan de hand van de perspectieven van een docent als professional, ontwerper, uitvoerder, pedagoog en

teamlid en de daarbij behorende relevante theorie. De proef wordt beoordeeld aan de hand van een beoordelingsformulier gerelateerd aan de rubrics die voor elk van de docentperspectieven zijn geformuleerd voor fase I.

Literatuur

Bij deze cursus worden de volgende algemeen didactische handboeken gebruikt:

- Ebbens, S. & Ettekoen, S. (2016). Effectief leren – basisboek. Groningen: Noordhoff Uitgevers B.V.
- Korthagen, F. & Lagerwerf, B. (2014). Een leraar van klasse. Den Haag: Boom Lemma Uitgevers
- Teitler, P. (2013). Lessen in orde. Bussum: Coutinho.
- Kohnstamm, R. (2009). Kleine ontwikkelingspsychologie: III de puberjaren. Houten: Bohn Stafleu van Loghum.

Oudere edities van bovenstaande boeken zijn over het algemeen goed bruikbaar.

Behalve van bovenstaande literatuur wordt veelvuldig gebruik gemaakt van relevante en actuele wetenschappelijke literatuur. Deze artikelen worden tijdens de cursus ter beschikking gesteld. De literatuur die bij VD gebruikt wordt is afhankelijk van het schoolvak waarvoor wordt opgeleid.

Overige informatie

Beheersing van de inhoud van het desbetreffende schoolvak wordt als voorkennis verondersteld.

Didactiek 2

Vakcode	O_MLDIDAC_2 ()
Periode	Periode 2+3
Credits	6.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	drs. L.J. van Well-van Grootheest
Examinator	drs. L.J. van Well-van Grootheest
Docent(en)	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, dr. B. de Vries, drs. A.J.C. Monquil, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort, F.L. de Vries, drs. J. Quartel MA
Lesmethode(n)	Werkgroep, Hoorcollege
Niveau	400

Doel vak

De cursus Didactiek 2 is onderdeel van de tweede fase (fase II) van de Universitaire Lerarenopleiding (ULO) van de VU, en loopt parallel aan de cursus Praktijk 2. De cursus omvat verschillende onderdelen die in samenhang worden aangeboden: algemene didactiek (AD), vakdidactiek (VD) en peergroup (PG).

Aan het eind van de cursus heeft de student de nodige algemeen didactische en vakdidactische bagage aan te reiken die nodig is voor het handelen als docent waarbij op basis van bestaande lesmaterialen wordt gewerkt.

Hierbij wordt nadrukkelijk aangesloten bij de ontwikkelingsfase waarin de docent-in-opleiding (dio) zich bevindt (zie inhoud).

Inhoud vak

Didactiek 2 is geordend rondom een aantal voor het beroep van docent fundamentele kernpraktijken. Bij Didactiek 2 staan de volgende kernpraktijken centraal: (1) leerprocessen zichtbaar maken, (2) leerprocessen bevorderen, (3) leerprocessen toetsen, (4) communiceren en leiding geven, (5) leerlingen verantwoordelijkheid geven (van docentgestuurd naar leerlinggestuurd) en (6) aandacht geven aan verschillen. Ten opzichte van de cursus Didactiek 1 wordt de focus verlegd van de (individuele) les naar het leerproces van de leerling. De reikwijdte van het didactisch denken en handelen wordt daarmee ook groter: er wordt een begin gemaakt met het ontwerpen en uitvoeren van reeksen van lessen.

De genoemde kernpraktijken komen expliciet aan de orde bij AD. Bij VD wordt aangesloten bij deze kernpraktijken en wordt de vertaalslag gemaakt naar het eigen (school)vak. Daarnaast worden bij VD belangrijke vakdidactische concepten en werkwijzen geïntroduceerd.

Bij PG staat wederom de eigen onderwijspraktijk van de dio centraal. Waar bij AD en VD de nadruk ligt op de rollen van de uitvoerende en ontwerpende docent en pedagoog, wordt bij PG nadrukkelijk vorm gegeven aan de rol van reflectieve onderzoekende professional. De samenhang tussen Didactiek 2 en Praktijk 2 komt onder andere tot stand doordat de dio en de werkplekbegeleider op school suggesties krijgen voor (observatie)opdrachten die kunnen bijdragen aan de ontwikkeling van de competenties die bij deze kernpraktijken horen. Alle inhoudscomponenten uit deze cursus worden tijdens de bijeenkomsten en in verwerking verbonden met de werkplekpraktijk van de student

In de laatste weken van de cursus is nadrukkelijker ruimte voor de eigen leervragen en behoefte van de student. Er worden keuzeworkshops aangeboden rondom uiteenlopende (vak)didactische thema's. Ook zijn er bijeenkomsten waarin dio's die veel moeite hebben met (o.a.) klassenmanagement extra coaching kunnen krijgen of extra aandacht verdienen op het gebied van bijvoorbeeld lesontwerp.

Onderwijsvorm

Alle onderwijs vindt plaats op de instituutsdag (maandag). Studenten zijn de hele dag aanwezig. In de ochtend is er een hoor/werkcollege AD, waarbij dio's van verschillende vakken samen zitten. De colleges AD worden steeds verzorgd door een tweetal docenten. In de middag is er een werkcollege VD onder begeleiding van de vakdidacticus. Deze colleges worden samen met dio's van hetzelfde vak in verschillende samenstellingen (homogeen en heterogeen) gevolgd.

Tenslotte zijn er, verspreid over de periode, drie PG bijeenkomsten, waarbij dio's van verschillende vakken in kleine groepen en onder begeleiding de eigen onderwijspraktijk onder de loep nemen en eventuele concerns daarbij bespreken.

Bij alle onderdelen (AD, VD en PG) wordt een actieve houding van de student gevraagd, zowel tijdens de bijeenkomsten daarbuiten. Regelmatig

worden er verwerkingsopdrachten gegeven, waar individueel of in groepsverband aan wordt gewerkt. Deze opdrachten worden formatief geëvalueerd, onder andere door middel van (peer)feedback.

Toetsvorm

Didactiek 2 wordt afgesloten met een geschreven basisproef waarin de studenten demonstreren dat zij een korte lessenreeks kunnen ontwerpen en (deels) uitvoeren en kunnen reflecteren op de manier waarop voorbereiding, uitvoer en afronding hebben plaatsgevonden. De proef bestaat uit een docentenhandleiding bij de lessenreeks, gebaseerd op bestaand lesmateriaal, (incl. een globale planning, twee uitgewerkte lesontwerpen, verantwoording op basis van praktijk en theorie, en eigen leerdoelen bij deze les), een videocompilatie (15 min.) van de gegeven lessen en een terugblik op ontwerp en uitvoering. Bij het ontwerpen en uitvoeren van de les staan de kernpraktijken behandeld in de colleges algemene didactiek en vakdidactiek centraal (met een focus op de leerling en het leerproces). De terugblik op ontwerp en uitvoering vindt plaats aan de hand van de reflectiekring van Korthagen, de perspectieven van een docent als professional, ontwerper, uitvoerder, pedagoog en teamlid en de daarbij behorende relevante theorie. De proef wordt beoordeeld aan de hand van een beoordelingsformulier gerelateerd aan de rubrics die voor elk van de docentperspectieven zijn geformuleerd voor fase 2.

Literatuur

Bij deze cursus worden de volgende algemeen didactische handboeken gebruikt:

- Ebbens, S. & Ettekoen, S. (2016). Effectief leren – basisboek. Groningen: Noordhoff Uitgevers B.V.
- Korthagen, F. & Lagerwerf, B. (2014). Een leraar van klasse. Den Haag: Boom Lemma Uitgevers
- Teitler, P. (2013). Lessen in orde. Bussum: Coutinho.
- Kohnstamm, R. (2009). Kleine ontwikkelingspsychologie: III de puberjaren. Houten: Bohn Stafleu van Loghum.

Oudere edities van bovenstaande boeken zijn over het algemeen goed bruikbaar.

Behalve van bovenstaande literatuur wordt veelvuldig gebruik gemaakt van relevante en actuele wetenschappelijke literatuur. Deze artikelen worden tijdens de cursus ter beschikking gesteld. De literatuur die bij VD gebruikt wordt is afhankelijk van het schoolvak waarvoor wordt opgeleid.

Overige informatie

Beheersing van de inhoud van het desbetreffende schoolvak wordt als voorkennis verondersteld.

Voorwaardelijk voor afronding van Didactiek 2: een voldoende beoordeling van Didactiek 1.

Didactiek 3

Vakcode	O_MLIDIDAC_3 ()
Periode	Periode 4+5+6
Credits	9.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.

Coördinator	dr. B. de Vries
Examinator	dr. B. de Vries
Docent(en)	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, dr. B. de Vries, drs. A.J.C. Monquill, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort, drs. J. Quartel MA
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak

De cursus Didactiek 3 is onderdeel van de derde en laatste fase (fase III) van de Universitaire Lerarenopleiding (ULO) van de VU, en loopt parallel aan de cursussen Praktijk 3 en POO 2. De omvang van de cursus is een heel semester.

Aan het eind van de cursus heeft de student de verdiepende pedagogische, didactische en vakdidactische bagage die nodig is voor het handelen als docent in complexe situaties. Hierbij wordt nadrukkelijk aangesloten bij de ontwikkelingsfase waarin de docent-in-opleiding (dio) zich bevindt (zie inhoud).

Inhoud vak

Het eerste blok van de cursus Didactiek 3 is weer geordend rondom een aantal voor het beroep van docent fundamentele kernpraktijken, namelijk: (1) differentiëren, (2) toetsen, (3) gedrags- en leerproblemen herkennen, (4) omgaan met gedrags- en leerproblemen, (5) mentor zijn en (6) een plek in de schoolorganisatie innemen.

De cursussen Didactiek 1 en 2 vormen samen het basisdeel van de Universitaire Lerarenopleiding (ULO); de cursus Didactiek 3 moet gezien worden als het verdiepingsdeel. In Didactiek 3 komen meer complexe thema's en kernpraktijken aan de orde. Het (vak)didactisch denken en handelen strekt zich nu ook uit over de lange termijn: er is bijvoorbeeld uitgebreid aandacht voor het vorm geven aan leerlijnen en het omgaan met gedrags- en leerproblemen. Ook wordt de dio nadrukkelijker uitgedaagd om een eigen visie op onderwijs vorm te geven en uit te dragen. Zo is de lesmethode niet langer leidend, maar wordt van dio's in toenemende mate verwacht zelf invulling te geven aan de inhoud en didactiek van de lessen (waarbij natuurlijk zowel bestaand als eigen materiaal kan worden gebruikt). Tenslotte zullen de (vak) didactische overwegingen die ten grondslag liggen aan de eigen visie onderbouwd moeten worden met behulp van relevante literatuur en eigen praktijkervaringen.

In het tweede blok van de cursus is er bij AD nadrukkelijk ruimte voor differentiatie en de eigen leerbehoefte van de student. Er worden verschillende keuzemodules aangeboden rondom uiteenlopende algemeen didactische thema's, zoals de multiculturele school, zorg op school, omgaan met ordeproblemen en internationalisering. Studenten worden uitgenodigd om (voor een deel) zelf invulling te geven aan deze keuzeruimte.

Onderwijsvorm

Alle onderwijs vindt plaats op de instituutsdag (maandag). Studenten zijn de hele dag aanwezig. In de ochtend is er een hoor/werkcollege AD, waarbij dio's van verschillende vakken samen zitten. De colleges AD worden steeds verzorgd door een tweetal docenten. In de middag is er een werkcollege VD onder begeleiding van de vakdidacticus. Deze colleges worden samen met dio's van hetzelfde vak in verschillende samenstellingen (homogeen en heterogeen) gevolgd.

Tenslotte zijn er, verspreid over de periode, drie PG bijeenkomsten, waarbij dio's van verschillende vakken in kleine groepen en onder begeleiding de eigen onderwijspraktijk onder de loep nemen en eventuele concerns daarbij bespreken.

Bij alle onderdelen (AD, VD en PG) wordt een actieve houding van de student gevraagd, zowel tijdens de bijeenkomsten daarbuiten. Regelmatig worden er verwerkingsopdrachten gegeven, waar individueel of in groepsverband aan wordt gewerkt. Deze opdrachten worden formatief geëvalueerd, onder andere door middel van (peer)feedback.

Toetsvorm

Didactiek 3 wordt afgesloten met een geschreven meesterproef waarin de studenten demonstreren dat zij een volle lessenreeks kunnen ontwerpen en uitvoeren en kunnen reflecteren op de manier waarop voorbereiding, uitvoer en afronding hebben plaatsgevonden. De proef bestaat uit een lessenreeks met een coherente leerlijn en expliciet gemaakte inhoudelijke en didactische keuzes. Het materiaal bevat: een lessenserie met een toets, een koppeling aan en neerslag van de (pedagogische) onderwijsvisie en visie op het vak van de student en de school, docentenhandleiding, leerlingmateriaal, evaluatie met collega's en leerlingen, een videocompilatie (15 min.) van de gegeven lessen en een terugblik op ontwerp en uitvoering. Bij het ontwerpen en uitvoeren van de les maakt de student een relevante selectie uit de kernpraktijken die tijdens de opleiding centraal hebben gestaan. De terugblik op ontwerp en uitvoering vindt plaats aan de hand van de reflectiecirkel van Korthagen, de perspectieven van een docent als professional, ontwerper, uitvoerder, pedagoog en teamlid en de daarbij behorende relevante theorie. Hierbij staat de student stil bij zijn/haar ontwikkeling op het gebied van deze rollen. De proef wordt beoordeeld aan de hand van een beoordelingsmodel gerelateerd aan de rubrics die voor elk van de docentperspectieven zijn geformuleerd voor fase 3 (een startbekwame docent).

Literatuur

Bij deze cursus worden de volgende algemeen didactische handboeken gebruikt:

- Ebbens, S. & Ettekoen, S. (2012). Effectief leren – basisboek. Groningen: Noordhoff Uitgevers B.V.
- Korthagen, F. & Lagerwerf, B. (2014). Een leraar van klasse. Den Haag: Boom Lemma Uitgevers
- Teitler, P. (2013). Lessen in orde. Bussum: Coutinho.
- Kohnstamm, R. (2014). Kleine ontwikkelingspsychologie: III de puberjaren. Houten: Bohn Stafleu van Loghum.

Daarnaast wordt veelvuldig gebruik gemaakt van relevante en actuele wetenschappelijke literatuur. Deze artikelen worden tijdens de cursus ter beschikking gesteld. De literatuur die bij VD gebruikt wordt is afhankelijk van het schoolvak waarvoor wordt opgeleid.

Overige informatie

Beheersing van de inhoud van het desbetreffende schoolvak wordt als voorkennis verondersteld.

Voorwaardelijk voor afronding van Didactiek 3: een voldoende beoordeling van Didactiek 2.

Differential geometry

Vakcode	X_400509 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Discrete Optimization

Vakcode	X_400445 (400445)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Bekker
Examinator	dr. R. Bekker
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Dynamical Systems

Vakcode	X_400429 (400429)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Docent(en)	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to introduce the student to concepts, examples, results and techniques for studying smooth dynamical systems generated by ordinary differential equations or maps.

The student learns to apply techniques from topology and analysis to study properties of dynamical systems.

Inhoud vak

We provide a broad introduction to the subject of dynamical systems. In particular we develop theory of topological dynamics, symbolic dynamics and hyperbolic dynamics. Several examples are used to illustrate the theory and clarify the development of the theory.

An aim of dynamical systems theory is to describe asymptotic properties of orbits for typical initial points. The strength and beauty of the theory lies herein that techniques to do so work not only for special examples but for large classes of dynamical systems. The focus of the course will always be on learning techniques to analyse dynamical systems without relying on explicit formulas for the dynamical system.

As an example, the hyperbolic torus automorphism $(x,y) \mapsto (2x - y, x + y) \pmod{1}$ on the torus $\mathbb{R}^2/\mathbb{Z}^2$ is a topologically transitive dynamical system for which most orbits lie dense in the torus. What makes the example relevant is that small perturbations of it share its relevant properties. The automorphism is for instance C^1 -structurally stable, so that a C^1 small perturbation is also topologically transitive. To see this requires much more advanced techniques than needed to study the linear automorphism. These techniques rely on the construction of stable and unstable manifolds.

The stable manifold theorem is among the highlights of the course. Another central result we cover is the structural stability theorem for hyperbolic sets.

A topical description of contents

1. Topological dynamics. Notions to describe attractors, limit sets and chaotic dynamics such as recurrence, topological transitivity, topological mixing.

2. Symbolic dynamics and their use to study chaotic dynamics. Full shift. Subshift of finite type. Topological Markov chain.

3. Aspects of bifurcation theory

4. Examples of chaotic dynamical systems such as hyperbolic torus automorphisms, the Smale horseshoe map and the solenoid.

5. Hyperbolic dynamics. Stable manifolds. Shadowing (finding real orbits near approximate orbits).

6. Structural stability and its relation with hyperbolicity. Shadowing as a technique to study structural stability.

Onderwijsvorm

Lectures (2x45 minutes) and exercise session (45 minutes) weekly.

Toetsvorm

Four sets of homework exercises will be given and there is a final exam. The final exam counts for 60% towards the final grade, and the homework exercises each for 10%.

Literatuur

M. Brin and G. Stuck, "Introduction to Dynamical Systems", Cambridge University Press.

Vereiste voorkennis

Prerequisite is material covered in a standard bachelor program in mathematics, containing in particular a bachelor course on ordinary differential equations, basic topology and elementary measure theory.

Aanbevolen voorkennis

In dynamical systems theory, results for dynamical systems generated by maps or differential equations are developed in parallel. Our focus will be on dynamical systems generated by maps. A bachelor course on differential equations treats how a differential equation gives rise to a flow, i.e. a dynamical system, and starts a study of its qualitative properties.

Notions and techniques from topological dynamical systems are used throughout the course and require knowledge of topology as taught in a bachelor programme.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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

Overige informatie

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

In dynamical systems theory, results for dynamical systems generated by maps or differential equations are developed in parallel. Our focus will be on dynamical systems generated by maps. A bachelor course on differential equations treats how a differential equation gives rise to a flow, i.e. a dynamical system, and starts a study of its qualitative properties.

Notions and techniques from topological dynamical systems are used throughout the course and require knowledge of topology as taught in a bachelor programme.

Dynamics of Networks

Vakcode	XMM_0007 ()
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

This course will not be taught in 2017/2018.

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl/>
Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

This course will not be taught in 2017/2018.

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login>

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

Overige informatie

This course will not be taught in 2017/2018.

Dynamische Systemen

Vakcode	X_400637 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.C.A.M. van der Vorst
Examinator	prof. dr. R.C.A.M. van der Vorst

Docent(en)	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

Aan het einde van deze cursus

1. kent de student de grafische en numerieke methoden voor het oplossen van eendimensionale niet-lineaire gewone differentiaalvergelijkingen;
2. kent de student de stelling voor existentie en eenduidigheid van oplossingen van gewone differentiaalvergelijkingen, en kan deze gebruiken;
3. kan de student meerdere bifurcaties met een of twee parameters herkennen, kwalificeren en berekenen;
4. kan de student stelsels van twee lineaire gewone differentiaalvergelijkingen oplossen en kwalificeren, en een faseplaatje voor deze vergelijkingen tekenen.
5. kan de student een faseplaatje van een eenvoudig stelsel niet-lineaire tweedimensionale ODEs tekenen, herkent hij/zij of zo'n ODE conservatief is, en kent hij/zij meerdere technieken om periodieke oplossingen van dergelijke ODEs te vinden (bijv. de stelling van Poincare-Bendixon, de slow-fast methode, en d.m.v. storingstheorie);
6. kan de student meerdere voorbeelden geven van problemen uit de wetenschap die met ODEs gemodelleerd worden.

Inhoud vak

Dit college is gewijd aan de theorie van niet-lineaire gewone differentiaalvergelijkingen. Aan de orde komen existentie en uniciteit van oplossingen, methoden voor het expliciet berekenen van oplossingen, de grafische methode voor eendimensionale vergelijkingen, bifurcaties, lineaire differentiaalvergelijkingen in twee dimensies, fasevlak analyse, limietcycli, storingstheorie, symmetrie en mechanische systemen. Aan de hand van concrete voorbeelden wordt geïllustreerd hoe men dergelijke problemen aanpakt.

Onderwijsvorm

De cursus bestaat uit een hoorcollege en een werkcollege per week.

Toetsvorm

Inleveropgaven en deeltentamens. De eerste inleveropgave telt voor 10% mee in het eindcijfer, het eerste deeltentamen voor 30%, de tweede inleveropgave voor 10% en het tweede deeltentamen voor 50%.

Literatuur

Steven Strogatz, "Nonlinear dynamics and chaos: with applications to physics, biology, chemistry and engineering", paperback edition, Westview Press, 1st ed, 2001. Daarnaast zullen op college soms aantekeningen worden verspreid.

Aanbevolen voorkennis

Eerstejaars cursussen Calculus en Analyse

Doelgroep

2W, 2W-B, CHW-doorstroom

Overige informatie

Actuele informatie over dit vak zal worden aangeboden op Canvas.

Elliptic Curves

Vakcode	X_400505 (400505)
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Forensic Probability and Statistics

Vakcode	XMM_0005 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>. Registration required via <https://elo.mastermath.nl/login/>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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grades from Mastermath to the administration of your university.

Foundations of General Relativity

Vakcode	XMM_0009 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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

Functional Analysis

Vakcode	X_400328 (400328)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Heuristic Methods in Operations Research

Vakcode	X_418006 (418006)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Bekker
Examinator	dr. R. Bekker
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/>

Doelgroep

mMath, mBA

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/>

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

History and Philosophy of Mathematics

Vakcode	XMU_0005 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/34774>

Overige informatie

This course is offered at the UvA. For more information contact: FNWI

Education Service Centre, Science Park 904, servicedesk-esc-

science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Interest Rate Models

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

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/37723>

Doelgroep

mSFM, mMath

Intekenprocedure

Registration is required via <https://www.sis.uva.nl> during the registration term before the start of the semester.

Introduction to Numerical Bifurcation Analysis of ODEs and Maps

Vakcode	XMM_0018 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Inverse Problems in Imaging

Vakcode	XMM_0004 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Inhoud vak

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Doelgroep
mMath

Lie Groups and Lie Algebras

Vakcode	XMM_40008 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Machine Learning Theory

Vakcode	XMM_0002 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/>

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>

Registration is mandatory and absolutely necessary for transferring your

grades from Mastermath to the administration of your university.

Master Project Mathematics

Vakcode	X_400355 (400355)
Periode	Ac. Jaar (september)
Credits	36.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. C.M. Quant
Examinator	dr. C.M. Quant
Niveau	600

Doel vak

The objectives of the master project are:

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

Inhoud vak

The Master's programme is concluded by an internal or external master project. An external project ("internship") is carried out within a business, industry or research facility other than the departments of Mathematics.

For an internal research project, the student starts by identifying a research topic in consultation with his/her supervisor. This leads to a research plan, which is recorded in the 'master project planner' and a copy of this form is given to the master coordinator. The planner can be found in VUnet (search for 'assessment form').

The project itself usually starts with a literature study, leads towards the boundaries of mathematical knowledge, and ideally culminates in original research by the student. The work is carried out by the student individually, while there are weekly or biweekly meetings with the supervisor to discuss progress and scientific questions. The work is presented in a master thesis, an interim presentation in the master seminar of your track and in a final (oral) presentation. (mandatory).

Onderwijsvorm

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

Toetsvorm

Assessment is based on attitude and execution (35%), the written master thesis (50%), the interim presentation in the master seminar (5%) and the final presentation (10%)

The form used for the assessment of a master project can be found in

VUnet (search for 'assessment form')

Literatuur

Assigned individually.

Vereiste voorkennis

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

Doelgroep

mMath

Overige informatie

If you are planning to start your external project within four months, please make an appointment with Annemieke van Goor (vangoor@few.vu.nl) at the Internship Office. Additional information can be found at

<http://www.few.vu.nl/en/current-students/internship-office-for-mathemati>

Master Project Mathematics (T,E track)

Vakcode	X_405037 (405037)
Periode	Ac. Jaar (september)
Credits	24.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. C.M. Quant
Examinator	dr. C.M. Quant
Niveau	600

Doel vak

The objectives of the master project are:

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

Inhoud vak

The Master's programme is concluded by an internal or external master project. An external project ("internship") is carried out within a business, industry or research facility other than the departments of Mathematics.

For an internal research project, the student starts by identifying a research topic in consultation with his/her supervisor. This leads to a research plan, which is recorded in the 'master project planner' and a copy of this form is given to the master coordinator. The planner can be found in VUnet (search for 'assessment form'). The project itself usually starts with a literature study, leads towards the boundaries of mathematical knowledge, and ideally culminates in original research by the student. The work is carried out by the student individually, while

there are weekly or biweekly meetings with the supervisor to discuss progress and scientific questions. The work is presented in a master thesis and in a final (oral) presentation.

Onderwijsvorm

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

Toetsvorm

Assessment is based on attitude and execution (35%), the written master thesis (50%) and the final presentation (15%). The form used for the assessment of a research project can be found on VUnet (search for 'assessment form').

Literatuur

assigned individually

Vereiste voorkennis

All but 6 EC of the mathematics courses need to be completed before starting the project.

Doelgroep

mMath

Overige informatie

If you are planning to start your external project within four months, please make an appointment with Annemieke van Goor (vangoor@few.vu.nl) at the Internship Office. Additional information can be found at

<http://www.few.vu.nl/en/current-students/internship-office-for-mathemati>

Master Seminar in Algebra and Geometry

Vakcode	XMU_41011 ()
Periode	Periode 1+2, Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/39515>

Master Seminar in Analysis and Dynamical Systems

Vakcode	XM_41013 ()
Periode	Periode 1+2, Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Hulshof
Examinator	prof. dr. J. Hulshof

Docent(en)	prof. dr. J. Hulshof, prof. dr. G.J.B. van den Berg
Lesmethode(n)	Werkgroep
Niveau	400

Doel vak

The aim of this course is to learn to read papers at a research level, organize the material for a seminar talk, and practice presentation skills for such talk, as well as to learn to constructively participate in a research seminar. The Master Seminar is intended for first-year master students. It replaces the course "Seminar Mathematics" of preceding years.

Inhoud vak

The Master Seminar consists of lectures on a broad range of research topics in Analysis and Dynamical Systems. There will be three types of lectures:

- * by the participating first-year students on research literature. Students will have a choice from a list, and can propose their own sources;
- * by staff members and PhD students in Amsterdam on topics closely related to their research;
- * by second-year students on their ongoing Master Projects.

Throughout the year, the students will have the opportunity to propose topics and speakers to invite at the Master Seminar.

Onderwijsvorm

Lecture, Seminar, Self-study

Toetsvorm

Attendance is compulsory. The course will be graded based on the presentations of the students, and their attendance and active participation. There will be no opportunity for a resit exam for this course.

Aanbevolen voorkennis

Good overall knowledge of various sides of analysis and dynamical systems.

Doelgroep

mMath

Overige informatie

Lecturers:
Prof. dr. G.J.B. van den Berg, Prof. dr. J. Hulshof

Master Seminar in Stochastics

Vakcode	XM_41011 ()
Periode	Periode 1+2, Periode 4+5
Credits	6.0
Voertaal	Engels

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.W.J. Meester
Examinator	prof. dr. R.W.J. Meester
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to learn to read papers at a research level, organize the material for a seminar talk, and practice presentation skills for such talk, as well as to learn to constructively participate in a research seminar. The Master Seminar is intended for first-year master students. It replaces the course "Seminar Mathematics" of preceding years.

Inhoud vak

The Master Seminar consists of lectures on a broad range of research topics in Stochastics.

There will be three types of lectures:

- by the participating first-year students on research literature (students will have a choice from a list, or can propose their own sources);
- by staff members and PhD students in Amsterdam on topics closely related to their research;
- by second-year students on their ongoing master projects.

Throughout the year, the students will have the opportunity to propose topics and speakers to invite at the Master Seminar.

Onderwijsvorm

Lecture, seminar, self-study

Toetsvorm

Attendance is compulsory. The course will be graded based on the presentations of the students, and their attendance and active participation. There will be no opportunity for a resit exam for this course.

Aanbevolen voorkennis

Good overall knowledge of various fields of stochastics.

Doelgroep

mMath, mSFM

Overige informatie

Lecturers: dr. E.N. Belitser, dr. A.V. den Boer

In the fall semester, this seminar takes place at the UvA; in the spring semester it is hosted at the VU.

Mathematical Biology

Vakcode	X_400504 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Coördinator	dr. R. Planque
Examinator	dr. R. Planque
Docent(en)	dr. R. Planque
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

After completion of the course, the student is able to

1. read and understand the research literature about (deterministic) models of biological phenomena
2. participate actively in projects that aim to model biological phenomena
3. derive mathematical equations from bookkeeping considerations
4. interpret mathematical results in the biological context that motivated the analysis; more precisely the point is that mathematical statements are translated into a relation between phenomena and the underlying mechanisms
5. use formal arguments (based on differences in the time- or spatial scale of various mechanisms) to simplify equations in a meaningful way
6. apply various analytical techniques to study phase portraits of planar ODEs representing ecological systems
7. derive and analyse linear diffusion equations and their solutions
8. apply bifurcation theory to study systems of nonlinear reaction-diffusion equations

Inhoud vak

1. Exploiting time scale differences : the quasi-steady-state-approximation
 - Michaelis Menten enzyme kinetics
 - Holling's functional response
 - excitable media: Fitzhugh-Nagumo

2. Phase plane analysis

Essentially an assignment : students work in couples through a series of exercises about prey-predator interaction. In a lecture we explain some key notions, such as linearized stability and Poincare-Bendixon.

3. Diffusion (mainly linear theory; partly in the form of assignments)

- various derivations of the diffusion equation
- the fundamental solution, superposition
- transport by diffusion: what distance in how much time?
- separation of variables, eigenfunctions/modes
- the asymptotic speed of propagation

4. Reaction-Diffusion (nonlinearity)

- travelling waves
- scalar equations do NOT generate stable patterns (in convex domains)
- Turing instability
- bifurcation theory
- transition layers (excitable systems)?

5. Age/size structured populations, cell cycle models

6. Chemotaxis

7. Branching processes, links to epidemiology

8. Adaptive Dynamics

9. Master equations and additional topics, as time permits.

Onderwijsvorm

-- lectures (notes are in preparation and should be ready by the time the course is given) which explain and illustrate the methods while referring to other sources for detailed accounts of the underlying mathematical theory
-- assignments which provide training in modelling and in the use of the methods. Students work on assignments, using both pen and paper and computer tools (MatLab).

Toetsvorm

Grades are to a large extent based on the handed in written texts and on oral presentations. Grading is based on 5 homework assignments and the final project. The average grade of the 5 home assignments will contribute 40% to the final grade. The written work on the paper will contribute another 40% and the remaining 20% will come from the oral presentation.

Literatuur

Lecture notes will be provided by the instructors. See also the course website for the latest details:

<http://www.few.vu.nl/~rplanque/Onderwijs/MathBio/>

Aanbevolen voorkennis

Basic knowledge about linear algebra, analysis, ODE, stochastic processes. (The key point, however, is the attitude: students should be willing to quickly fill in gaps in background knowledge.)

Doelgroep

MSc Mathematics

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login>.

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

Overige informatie

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

Measure Theoretical Probability

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

Inhoud vak

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

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

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

Doelgroep

mMath, mSFM

Intekenprocedure

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Measure Theory

Vakcode	X_401028 (401028)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.W.J. Meester
Examinator	prof. dr. R.W.J. Meester
Docent(en)	prof. dr. R.W.J. Meester
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

After this course, the student will know and understand the basic concepts of measure theory and the theory of Lebesgue integration, as laid out in the content of the course. The student will understand the main proof techniques in the field, and he will also be able to apply the theory to concrete examples. The student should also be able to write elementary proofs himself, as well as guided more advanced proofs.

The student will also understand and use the unifying nature of the subject, and in particular understand that sums and integrals are two appearances of the same underlying abstract notion.

Onderwijsvorm

Classical classes with exercise classes.

Vereiste voorkennis

Basics of calculus.

Mechanics and Thermodynamics in the Cell

Vakcode	X_422589 ()
Periode	Periode 2
Credits	6.0
Voertaal	Nederlands

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. ir. E.J.G. Peterman
Examinator	prof. dr. ir. E.J.G. Peterman
Docent(en)	prof. dr. ir. E.J.G. Peterman, prof. dr. ir. G.J.L. Wuite
Lesmethode(n)	Werkcollege
Niveau	400

Doel vak

- To provide insight in how the basic tools and knowledge of physics and physical chemistry (in particular mechanics, statistical physics and thermodynamics) and mathematics can be used to better understand biology on the cellular and molecular level.
- To be able to understand and build quantitative models that provide a deeper insight in living systems.
- To provide insight in how quantitative data obtained from microscopic imaging methods can be used to increase the understanding of biological systems.

Inhoud vak

- Biology by Numbers
- Mechanical and Chemical Equilibrium in the Living Cell
- Entropy Rules!
- Two-State Systems: From Ion Channels to Cooperative Binding
- Random Walks and the Structure of Macromolecules
- Beam Theory: Architecture for Cells and Skeletons
- The Mathematics of Water
- A Statistical View of Biological Dynamics
- Rate Equations and Dynamics in the Cell

Onderwijsvorm

Lectures (4h per week) & Tutorials (2h per week)

Toetsvorm

Written exam + 2 or 3 witten tests on parts of the course contents.

Literatuur

Phillips, R., Kondev, J., and Theriot, J., Physical Biology of the Cell. 2nd Edition New York: Garland Science, 2012 (ISBN 0815344503). (1st edition is also fine)

Aanbevolen voorkennis

Mathematics: Calculus & Mathematische Methoden (or comparable)
Physics: basics of mechanics & thermodynamics

Doelgroep

3N, 3MNW mi-BB, 3WN, 3S

Modular Forms

Vakcode	X_400599 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Coördinator	dr. S.R. Dahmen
Niveau	400

Inhoud vak

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

Doelgroep

mMATH

Intekenprocedure

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Neurogenomics

Vakcode	AM_1007 ()
Periode	Periode 3
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. A.B. Smit
Examinator	prof. dr. A.B. Smit
Lesmethode(n)	Hoorcollege, Werkgroep, Computerpracticum
Niveau	500

Doel vak

To provide the Master of Neuroscience students with a solid basis in understanding the genome and working mechanisms and function of genes in relation to the development and functioning of the nervous system.

Inhoud vak

The course will address the various aspects of functional analysis of the genome, by addressing the following topics:

- The search for genes and gene variants which are underlying neuronal physiology and pathology, including forward genetics and gene-hunting strategies
- Functional analysis of genes through reverse genetics
- Gene expression analysis of neuronal cells and brain areas (gene expression profiling)
- The analysis of proteins (proteomics) and complexes thereof.
- Simulation of genetic and protein networks
- The introduction of various model organisms relevant for neurogenomics research, such as, man, mouse, Drosophilla, C. elegans, and zebrafish.

Onderwijsvorm

Lectures, experiments, workshops, student presentations, computer practicals

Toetsvorm

Written examination, open end questions. Practical task, presentation and literature evaluation.

Literatuur

To be announced on Canvas

Vereiste voorkennis

Bachelor Biology, Biomedical Sciences, Psychology with profile Biological Psychology or Neurophysiology

Intekenprocedure

Students need to enroll via VUnet

Students not enrolled in the VU master's in Neurosciences, need to contact the course coordinator prior to enrollment

Overige informatie

Language: tuition in English

Nonlinear Waves

Vakcode	XMM_40010 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Docent(en)	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Numerical Linear Algebra

Vakcode	X_400329 (400329)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

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

Doelgroep

mMath

Intekenprocedure

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

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

Numerical Methods

Vakcode	X_401039 (401039)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Docent(en)	prof. dr. G.J.B. van den Berg
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	300

Doel vak

- Students are familiar with the main algorithms of numerical analysis and know how to implement these efficient in Matlab.
- Students can apply methods from numerical analysis to solve a variety of problems (both in applications and in mathematical analysis).
- Students can evaluate the reliability of numerical methods.

Inhoud vak

Numerical methods are used frequently in all areas of science, such as fluid dynamics, meteorology and financial risk management. Moreover, techniques from numerical analysis play an important role in mathematical research on differential equations, stochastics, optimization, etcetera.

We focus on the main numerical methods from modern-day analysis and scientific computing. The theory is implemented in hands-on practical assignments. Active participation is expected. The list of subjects includes: error analysis, systems of nonlinear equations, eigenvalue problems, least square methods, fast Fourier transform, ordinary and partial differential equations. Applications include phone number recognition, ranking algorithms, curve following and planet motions.

Onderwijsvorm

Lectures alternated with practical work in the computer rooms.
A number of matlab assignments form an integral part of the course.

Toetsvorm

Active participation in the lectures is expected.
The grade is determined on the basis of the assignment (matlab code and short reports).

Literatuur

Numerical Analysis by Richard Burden and J. Douglas Faires
ISBN: 978-0538735643

Vereiste voorkennis

A basic course in linear algebra (e.g. X_400041, X_400042, X_400638 or X_400639)

Doelgroep

2W, 2W-B, mBA, mBA-D

Intekenprocedure

Enroll on VUnet

Operator Algebras

Vakcode	X_418062 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

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

Optimization of Business Processes

Vakcode	X_400422 (400422)
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Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.M. Koole
Examinator	prof. dr. G.M. Koole
Docent(en)	prof. dr. G.M. Koole
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

To learn about applications of stochastic operations research in the context of a number of important application areas, especially manufacturing and services.

Inhoud vak

We deal with a number of application areas of stochastic modeling: production logistics, call centers, health care and revenue management. For each area we present quantitative problems and discuss how they can be solved using mathematical models. We also discuss a number of new models. Several guest lectures are given by people from industry.

Onderwijsvorm

Lectures and practical work.

Toetsvorm

Written examination, individual assignments, and a book presentation.

Literatuur

Lecture notes.

Aanbevolen voorkennis

Applied Stochastic Modeling or equivalent knowledge

Doelgroep

mBA, mBA-D, mMath

Overige informatie

Attendance mandatory.

Parallel Algorithms

Vakcode	X_418011 (418011)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

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

Partial Differential Equations

Vakcode	X_400330 (400330)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Hulshof
Examinator	prof. dr. J. Hulshof
Docent(en)	prof. dr. J. Hulshof
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

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

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

Doelgroep

mMath

Intekenprocedure

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

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

Peergroup fase 1

Vakcode	O_MLPEERGR_1 ()
Periode	Periode 1+2+3
Credits	0.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	drs. I. Pauw
Examinator	dr. A. Handelzalts
Lesmethode(n)	Werkgroep
Niveau	400

Doel vak

In de peergroup staat de rol als 'professional' centraal. Studenten leren de regie te nemen over hun eigen leerproces en hun visie op onderwijs te beschrijven. Ze ontwikkelen een professionele identiteit, waarin ze de eisen die het beroep van docent aan ze stelt verbinden met eigen waarden en motieven. In peergroups reflecteren studenten op hun handelen in de praktijk, leiden daaruit ontwikkelpunten af, formuleren acties en evalueren deze. Verschillende instrumenten en methodes worden gebruikt (logboek, reflectiecirkel, intervisie, videoreflectie, etc.) om de student in staat te stellen de complexiteit van de onderwijspraktijk te doorgronden en hiervan te leren.

Peergroup Fase 2

Vakcode	O_MLPEERGR_2 ()
Periode	Periode 3+4+5
Credits	0.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Lesmethode(n)	Werkgroep

Doel vak

In de peergroup staat de rol als 'professional' centraal. Studenten leren de regie te nemen over hun eigen leerproces en hun visie op onderwijs te beschrijven. Ze ontwikkelen een professionele identiteit, waarin ze de eisen die het beroep van docent aan ze stelt verbinden met eigen waarden en motieven. In peergroups reflecteren studenten op hun handelen in de praktijk, leiden daaruit ontwikkelpunten af, formuleren acties en evalueren deze. Verschillende instrumenten en methodes worden gebruikt (logboek, reflectiecirkel, intervisie, videoreflectie, etc.) om de student in staat te stellen de complexiteit van de onderwijspraktijk te doorgronden en hiervan te leren.

Percolation: from Introduction to Frontiers of Current Research

Vakcode	XMM_0012 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

To give an introduction to percolation theory, and study some of the newest developments.

Inhoud vak

Percolation theory deals with the connectivity properties of large, possibly infinite, networks (for instance a hexagonal lattice) from which a certain fraction q of the nodes or bonds is randomly removed. It is inspired by phenomena in physics and life sciences, but has become a mathematical topic of independent interest. It provides one of the mathematically most elegant examples of critical behaviour: there is a critical value of the parameter q at which the global properties of the system change drastically.

The first part of the course gives a general introduction and treats several classical results, in particular the uniqueness of the infinite cluster (in any dimension) and a proof that the critical probability for bond percolation on the square lattice is $1/2$. Then we turn to more recent exciting developments, which started around 2000 and where work by Fields medalist Stanislav Smirnov on conformal invariance plays a key role. Finally we discuss current research and open problems, including the question of absence of percolation at the critical point. This is known for dimension 2 and for sufficiently high dimensions. For other dimensions (e.g. 3) this is one of the biggest current open problems.

Onderwijsvorm

Lecture

Toetsvorm

Written exam

Literatuur

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

Vereiste voorkennis

Basic knowledge of probability and analysis. Some knowledge of conformal maps

is useful in the second half of the course, but not necessary (what we use will be introduced and explained).

Aanbevolen voorkennis

Basic knowledge of probability and analysis. Some knowledge of conformal maps

is useful in the second half of the course, but not necessary (what we use will be introduced and explained).

Doelgroep

mMath, Master Mathematics, Master SfM.

Intekenprocedure

<https://elo.mastermath.nl/login/>

Poisson Geometry

Vakcode	XMM_0011 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	500

Inhoud vak

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

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Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

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Portfolio Theory

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

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/34857>

Doelgroep

mSFM, mMath

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Praktijk 1

Vakcode	O_MLPRAK_1 ()
Periode	Periode 1
Credits	6.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	drs. Y.G. Meindersma
Examinator	drs. Y.G. Meindersma

Docent(en)	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, drs. A.J.C. Monquil, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort, F.L. de Vries, drs. J. Quartel MA
Lesmethode(n)	Werkgroep
Niveau	400

Inhoud vak

Op de school wordt de aandacht op dezelfde kernpraktijken gericht als gedurende de instituutopleiding. De werkplekbegeleider is op de hoogte van de onderwerpen die op de instituutdag gebruikt worden en gebruikt dezelfde rubric als de instituutopleiders en vakdidactici om de vorderingen van de studenten te beoordelen.

Onderwijsvorm

Onder begeleiding van de werkplekbegeleider nemen de studenten steeds een groter en actiever aandeel in het lesgeven en werken in de school. Studenten met een baan (zij-instromers, onderwijstrainees etc) geven in dit stadium al zelfstandig les. Bij deze studenten is de nadruk bij de begeleiding vanuit de werkplekbegeleider op het niveau van didactische handelen in de les.

Toetsvorm

Op de school geven de studenten een presentatie over hun prestaties in de eerste acht weken. Dat doen ze aan de hand van de relevante rollen (vier van de vijf waarbij uitvoerder, ontwerper en pedagoog de meeste aandacht krijgen bij de reflectie op het lesgeven). De werkplekbegeleider gebruikt de rubric om het functioneren van de studenten in de klas te evalueren.

Praktijk 2

Vakcode	O_MLPRAK_2 ()
Periode	Periode 2+3
Credits	9.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	dr. A. Handelzalts
Examinator	drs. Y.G. Meindersma
Docent(en)	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. C.D.P. van Oeveren, drs. S. Donszelmann, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, drs. A.J.C. Monquil, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort, F.L. de Vries, drs. J. Quartel MA
Lesmethode(n)	Werkgroep
Niveau	400

Inhoud vak

Tijdens de praktijkstage werken studenten aan het verder ontwikkelen van de kernpraktijken die in het instituutsdeel aan de orde zijn gekomen. Net als in fase 1 komt de verbinding tussen theorie en praktijk aan de orde. Op de werkplek wordt de aandacht op dezelfde vaardigheden gericht als tijdens de instituutsopleiding. Dit betekent dat studenten, samen met hun werkplekbegeleider, gericht werken aan de verschillende thema's besproken in de (vak)didactiekcolleges van Didactiek 1 en 2.

Onderwijsvorm

Onder begeleiding van de werkplekbegeleider nemen de studenten steeds een groter en actiever aandeel in het lesgeven en werken in de school.

Toetsvorm

De praktijkbeoordeling wordt uitgevoerd door de vakdidacticus/instituutsopleider en de werkplekbegeleider aan de hand van het eerste lesbezoek en de ingevulde rubric.

Overige informatie

Voorwaardelijk voor afronding van Praktijk 2: een voldoende beoordeling van Praktijk 1 en Didactiek 1.

Praktijk 3

Vakcode	O_MLPRAK_3 ()
Periode	Periode 4+5+6
Credits	15.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	drs. Y.G. Meindersma
Examinator	drs. Y.G. Meindersma
Docent(en)	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, drs. A.J.C. Monquil, drs. J.B. Penninx, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort
Niveau	400

Inhoud vak

In het verdiepingsdeel gaat de student meer en meer zelf(standig) lesgeven. De voorbereiding en evaluatie wordt samen met de werkplekbegeleider gedaan. Op de werkplek komen dezelfde onderwerpen aan de orde als in het instituut: vakdidactische verdieping van onderwijsconcepten en –strategieën, aandacht voor het afstemmen van onderwijs op de behoeften van individuele leerlingen, diversiteit en excellentie.

Op de werkplek wordt de aandacht op dezelfde vaardigheden gericht als tijdens de instituutsopleiding. Dit betekent dat studenten, samen met hun werkplekbegeleider, gericht werken aan de verschillende thema's besproken in de vakdidactiekdidactiek en de keuze modules. Het instituut biedt hiervoor concrete handreikingen aan in de vorm van een stageplan (gekoppeld aan de rubric).

Onderwijsvorm

Onder begeleiding van de werkplekbegeleider nemen de studenten steeds een groter en actiever aandeel in het lesgeven en werken in de school.

Toetsvorm

Voor de beoordeling van Praktijk 3 maakt de student in blok 6 een afspraak met zijn WPB en SO voor een afrondend lesbezoek. In overleg met de WPB en SO bepaalt de student welke klas hiervoor het meest geschikt is.

Na afloop van het lesbezoek blikken WPB en SO met de student terug op de les. WPB en SO beoordelen de les aan de hand van de checklist (rubric).

Gecombineerd met het oordeel van vakdidacticus aan de hand van de tweede lesbezoek wordt een cijfer vastgesteld.

Overige informatie

Voorwaarden voor afronding van Praktijk 3: een voldoende beoordeling van Praktijk 2 en Didactiek 2.

Praktijk 3 voor 2-jarige Master

Vakcode	O_M2PRAK3 ()
Credits	15.0
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Niveau	400

Inhoud vak

In het verdiepingsdeel gaat de student meer en meer zelf(standig) lesgeven. De voorbereiding en evaluatie wordt samen met de werkplekbegeleider gedaan. Op de werkplek komen dezelfde onderwerpen aan de orde als in het instituut: vakdidactische verdieping van onderwijsconcepten en –strategieën, aandacht voor het afstemmen van onderwijs op de behoeften van individuele leerlingen, diversiteit en excellentie.

Op de werkplek wordt de aandacht op dezelfde vaardigheden gericht als tijdens de instituutsopleiding. Dit betekent dat studenten, samen met hun werkplekbegeleider, gericht werken aan de verschillende thema's besproken in de vakdidactiekdidactiek en de keuze modules. Het instituut biedt hiervoor concrete handreikingen aan in de vorm van een stageplan (gekoppeld aan de rubric).

Onderwijsvorm

Onder begeleiding van de werkplekbegeleider nemen de studenten steeds een groter en actiever aandeel in het lesgeven en werken in de school.

Toetsvorm

Voor de beoordeling van Praktijk 3 maakt de student in blok 6 een afspraak met zijn WPB en SO voor een afrondend lesbezoek. In overleg met de WPB en SO bepaalt de student welke klas hiervoor het meest geschikt is.

Na afloop van het lesbezoek blikken WPB en SO met de student terug op de les. WPB en SO beoordelen de les aan de hand van de checklist (rubric).

Gecombineerd met het oordeel van vakdidacticus aan de hand van de tweede

lesbezoek wordt een cijfer vastgesteld.

Overige informatie

Voorwaarden voor afronding van Praktijk 3: een voldoende beoordeling van Praktijk 2 en Didactiek 2.

Praktijkonderzoek 1

Vakcode	O_MLPROZ_1 ()
Periode	Periode 3
Credits	3.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	dr. H.B. Westbroek
Examinator	dr. H.B. Westbroek
Docent(en)	drs. J.K.W. Riksen, dr. J.M.H. Swennen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, prof. dr. M. Meeter, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. T. Bosma, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, dr. B. de Vries, drs. A.J.C. Monquill, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort, drs. J. Quartel MA
Lesmethode(n)	Werkgroep, Hoorcollege
Niveau	400

Doel vak

Tijdens praktijkonderzoek 1 en 2 vullen studenten de tijdens hun master opgedane onderzoeksvaardigheden aan met onderzoeksvaardigheden voor de eigen onderwijspraktijk.

Inhoud vak

In praktijkonderzoek 1 richt de opdracht zich primair op het leren herkennen, waarderen en gebruiken van verschillen type bronnen (praktijkbronnen, vakliteratuur en wetenschappelijke literatuur) om praktijkproblemen te analyseren en te duiden. Studenten krijgen handvatten aangereikt om bronnen te zoeken en te beoordelen op kwaliteit en bruikbaarheid voor de (eigen) praktijk.

Onderwijsvorm

De begeleiding vindt plaats op het instituut en bestaat uit de volgende vormen: college en werkcolleges.

Toetsvorm

Praktijkonderzoek 1 wordt afgesloten met een onderbouwd advies voor de (eigen) praktijk

Literatuur

Relevante en actuele artikelen over verschillende kernpraktijken die in fase 1 en 2 aan de orde zijn geweest. De artikelen worden beschikbaar gesteld, en zelf opgezocht

Overige informatie

Binnen Didactiek 1 en 2 hebben de studenten kennisgemaakt met het toepassen van relevante bronnen, waaronder onderzoeksartikelen, om praktijksituaties te duiden.

Praktijkonderzoek 2

Vakcode	O_MLPROZ_2 ()
Periode	Periode 4+5+6
Credits	6.0
Voertaal	Nederlands
Faculteit	Fac. der Gedrags- en Bewegingswetensch.
Coördinator	dr. H.B. Westbroek
Examinator	dr. H.B. Westbroek
Docent(en)	drs. J.K.W. Riksen, dr. J.M.H. Swennen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, prof. dr. M. Meeter, drs. I. Pauw, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. T. Bosma, dr. H.B. Westbroek, C.L. Geraedts, dr. A.A. Kaal, dr. A. Handelzalts, dr. B. de Vries, drs. A.J.C. Monquil, drs. J.B. Penninx, drs. L.A. van der Bruggen, W. Maas, drs. H. Stouthart, drs. N.H. Ypenburg, drs. E.D. van Noort
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

Tijdens het praktijkonderzoek vullen studenten de tijdens hun master opgedane onderzoeksvaardigheden aan met onderzoeksvaardigheden voor de eigen onderwijspraktijk.

Inhoud vak

In Praktijkonderzoek 2 worden onderzoeksvragen uit de onderwijspraktijk vertaald in empirisch onderzoek. De student analyseert data uit de onderwijspraktijk om een antwoord te vinden op de onderzoeksvraag en rapporteert de bevindingen in een onderzoeksverslag en een presentatie aan de collega's in de school en aan mede-studenten op het instituut. Er wordt met name aandacht besteed aan de aard en doelen van praktijkonderzoek, en consequenties die dit heeft voor kwaliteitseisen en de betekenis van praktijkonderzoek voor de beroepspraktijk.

Onderwijsvorm

De begeleiding vindt plaats op school (academische opleidingsschool) en op het instituut en bestaat uit de volgende vormen: colleges, werkcolleges, duo-begeleiding (VO docent/ULO docent).

Toetsvorm

Praktijkonderzoek 2 wordt afgesloten met een verslag en een posterpresentatie over hun bevindingen en ze delen hun bevindingen zowel op het instituut als op school.

Literatuur

- Van der Donk, C., & Van Lanen, B. (2012). Praktijkonderzoek in de school. 2de druk. Coutinho, Bussum. ISBN 9789046903001
- Relevante en actuele artikelen over het onderzoeksonderwerp (via

Canvas en zelf verzamelen).

Vereiste voorkennis

Vereiste voorkennis: Praktijkonderzoek 1 en onderzoekservaring op masterniveau in het eigen domeinvak.

Probabilistic and Extremal Combinatorics

Vakcode	X_418118 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

<https://elo.mastermath.nl/login/>

Quantum Computing

Vakcode	XMM_0013 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

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

Quantum Groups and Integrable Systems

Vakcode	XMU_0004 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/40281>

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Quantum Groups and Knot Theory

Vakcode	X_400343 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/17254>

Doelgroep

mMath

Intekenprocedure

Registration is required via <https://www.sis.uva.nl> during the registration term before the start of the semester.

Queueing Theory

Vakcode	X_400397 (400397)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl/>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/>

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

Queues and Levy Fluctuation Theory

Vakcode	XMU_0002 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/40282>

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Quivers

Vakcode	XMU_0003 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/40280>

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Riemann Surfaces

Vakcode	X_400325 (400325)
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Lesmethode(n)	Hoorcollege

Niveau	400
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Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/>. Registration required via

<https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>

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

Scheduling

Vakcode	X_400396 (400396)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Bekker
Examinator	dr. R. Bekker
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/>

Doelgroep

mMath, mBA

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/>

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

Scientific Writing in English

Vakcode	X_400512 ()
Periode	Periode 4
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	M. van den Hoorn

Examinator	M. van den Hoorn
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to provide Master's students with the essential linguistic know-how for writing a scientific article in English that is well organized, idiomatically and stylistically appropriate and grammatically correct.

At the end of the course students

- know how to structure a scientific article;
- know what the information elements are in parts of their scientific article;
- know how to produce clear and well-structured texts on complex subjects;
- know how to cite sources effectively;
- know how to write well-structured and coherent paragraphs;
- know how to construct effective sentences;
- know what collocations are and how to use them appropriately;
- know how to adopt the right style (formal style, cohesive style, conciseness, hedging)
- know how to avoid the pitfalls of English grammar;
- know how to use punctuation marks correctly;
- know what their own strengths and weaknesses are in writing;
- know how to give effective peer feedback.

Final texts may contain occasional spelling, grammatical or word choice errors, but these will not distract from the general effectiveness of the text.

Inhoud vak

The course will start with a general introduction to scientific writing in English. Taking a top-down approach, we will then analyse the structure of a scientific article in more detail. As we examine each section of an article, we will peel back the layers and discover how paragraphs are structured, what tools are available to ensure coherence within and among paragraphs, how to write effective and grammatically correct sentences and how to choose words carefully and use them effectively.

Topics addressed during the course include the following:

- Structuring a scientific article
- Considering reading strategies: who is your readership? How do they read your text? What do they expect? How does that affect your writing?
- Writing well-structured and coherent paragraphs
- Composing effective sentences (sophisticated word order, information distribution).
- Arguing convincingly – avoiding logical fallacies
- Academic tone and style: hedging – why, how, where?
- Using the passive effectively
- Understanding grammar (tenses, word order, etc.)
- Understanding punctuation
- Referring to sources: summarising, paraphrasing, quoting (how and when?)
- Avoiding plagiarism
- Vocabulary development: using appropriate vocabulary and collocations

Onderwijsvorm

Scientific Writing in English is an eight-week course and consists of 2 contact hours a week. Students are required to spend at least 6 to 8 hours of homework per week. They will work through a phased series of exercises that conclude with the requirement to write several text parts (Introduction, Methods, Discussion and Abstract). Feedback on the writing assignments is given by the course teacher and by peers.

Toetsvorm

Students will receive the three course credits when they meet the following requirements:

Students hand in three writing assignments (Introduction, Methods, Discussion)

Students get a pass mark for all writing assignments;

Students provide elaborate peer feedback (Introduction, Methods, Discussion, Abstract);

Students attend at least 7 out of 8 sessions;

Students are well prepared for each session (i.e. do all homework assignments);

Students participate actively in class;

Students do not plagiarise or self-plagiarise.

Writing assignments:

1. If students have a BSc thesis in a traditional thesis form (e.g., 20+ pages) and written in English, they may use this for the writing assignments.
2. If students have a BSc thesis in a traditional form (e.g., 20+ pages) written in another language than English, they may use this for the writing assignments.
3. If students have written a paper or report in English that's not already in article form, they may use this for the writing assignment.
4. If students are working on their MSc thesis or internship report when taking Scientific Writing in English, they may use this for the writing assignments. They will have to notify their supervisor to make sure that they won't be accused of self-plagiarism.
5. If students cannot or do not wish to use any of the above-mentioned texts for the writing assignments (1-4), they are expected to do a limited Literature Review on a topic in their field of research, using at least 5 articles.

Students are not allowed to use the following texts for the writing assignments:

1. A BSc thesis written in English that's already in article form.
2. A MSc thesis written in English that's already in article form (and that has already been marked).
3. An internship report written in English that's already in article form (and that has already been marked).
4. A paper or report written in English that's already in article form.

Literatuur

Effective Scientific Writing: An Advanced Learner's guide to Better English, 4th edition (February 2016) (A. Bolt & W. Bruins, ISBN 978 90 8659 617 1). VU bookstore: €27.95.

Doelgroep

This course is only open to students of the two-year Master's programmes of the Faculty of Sciences. These students are only eligible to the

course if they have already conducted scientific research (e.g. for their Bachelor's thesis) or if they will be working on a research project when taking Scientific Writing in English.

Overige informatie

- To do well, students are expected to attend all lessons. Group schedules are to be found at rooster.vu.nl and on Canvas.
- A VUnet registration for this course automatically gives access to the corresponding Canvas site. Group registration only takes place via Canvas (general groups: registration by students following FALW programmes offering this course; groups assigned to specific studies: registration through programme and course coordinator).
- Make sure Scientific Writing in English does not overlap with another course.
- If you have registered for a group in Canvas, you are expected to attend all sessions (eight). If you decide to withdraw from the course, do so in time in VUnet. This will avoid a 'fail' on your grade list for not taking part in this course and allows other students to fill in a possible very wanted group spot.
- For specific Canvas matters concerning this course, please contact canvas.beta@vu.nl.
- Full time students with their main registration at VU will be given preferential treatment for placement in this course. For secondary students proof of enrollment is not a guarantee of placement.

Selected Areas in Cryptology

Vakcode	XMM_40011 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via

<https://elo.mastermath.nl/login/>.

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

Semidefinite Optimization

Vakcode	XMM_0015 ()
Periode	Periode 4+5

Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl/>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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

Set Theory

Vakcode	X_418035 (418035)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

This course is part of the joint national master programme in mathematics. For schedules, course locations and course descriptions see

<https://elo.mastermath.nl/> . Registration required via

<https://elo.mastermath.nl/login/>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Simulation Methods in Statistics

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

Niveau	400
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Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/31393>

Doelgroep

mMath, mSFM

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Spatial Statistics

Vakcode	XMM_0001 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login>

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

Statistical Data Analysis

Vakcode	X_401029 (401029)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. D. Dobler
Examinator	dr. D. Dobler
Docent(en)	dr. D. Dobler, prof. dr. M.C.M. de Gunst
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

This course acquaints the students with the theory and application of several widely used statistical analysis techniques. After completing this course the student knows the theory behind the different techniques and is able to verify which techniques are applicable to a given data set. Using the learned statistical tools, the student is able to summarize and analyze real data sets using the statistical software package R.

Inhoud vak

This is an advanced level statistical data analysis course that builds on an introductory course on statistics, e.g. Statistics (Algemene Statistiek). The course introduces the students to several widely used statistical models and methods, and the students are taught how to apply these tools to real data with the use of the statistical software package R. The following subjects are covered:

- summarizing data;
- investigating the distribution of data;
- robust methods;
- non-parametric methods;
- bootstrap;
- two-sample problems;
- contingency tables;
- multiple linear regression.

The course is a combination of theory (in the lectures) and practice (in the computer classes). Since the solutions of the computer assignments are discussed during the lectures, the theory is explicitly linked to the practice of statistical data analysis.

Onderwijsvorm

Lectures, computer classes.

Toetsvorm

Weekly homework assignments in R and written exam.

Literatuur

Lecture notes.

Doelgroep

2BA, 2W, 2W-B, 3W, 3W-B, 3Ect.

Statistical Models

Vakcode	X_400418 (400418)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. E.N. Belitser
Examinator	dr. E.N. Belitser
Docent(en)	dr. E.N. Belitser
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The goals of this course are to get acquainted with some of the most commonly used statistical models, to learn how to apply these models in valid settings, and to understand the basic theory behind these models.

Inhoud vak

Analysis of Variance, Generalized Linear Models, Non-linear Models, Time Series.

Onderwijsvorm

Lectures and tutorials.

Toetsvorm

Assignments and examination.

Literatuur

Lecture notes "Statistical Models" by M.C.M. de Gunst.

Vereiste voorkennis

Statistics course.

Aanbevolen voorkennis

Linear Algebra, Probability Theory and Statistics. Statistical Data Analysis (X_401029)

Doelgroep

mBA, mBA-D, mMath

Overige informatie

Students will use statistical package R (www.r-project.org/) for data analysis.

Statistical Theory for High- and Infinite-Dimensional Statistics

Vakcode	XMM_0008 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Registration required via <https://elo.mastermath.nl/login/>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>.

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

Statistics

Vakcode	X_400004 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	M. Frolkova
Examinator	M. Frolkova
Docent(en)	M. Frolkova
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	200

Doel vak

The course Statistics is a first introduction to the basic concepts of mathematical statistics. After completing this course the student can set up a basic statistical model, estimate parameters in the model, formulate and perform standard hypothesis tests and construct confidence intervals.

Inhoud vak

Statistics is the field of inferring conclusions about underlying distributions of observed data. In this course we deal with the topics: statistical models, estimation, hypothesis testing and confidence intervals. The theory is illustrated with a number of practical examples.

In this course, we limit ourselves to parametric statistical models, which means that underlying distributions are known up to some unknown parameter(s).

Onderwijsvorm

Lectures, exercise classes

Toetsvorm

Two written exams

Literatuur

"An introduction to mathematical statistics" by Fetsje Bijma, Marianne Jonker and Aad van der Vaart.

Aanbevolen voorkennis

Students should master calculus and probability theory.

Doelgroep

2BA, 2W

Statistics for High-Dimensional Data

Vakcode	X_405113 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. M. van de Wiel
Examinator	dr. M. van de Wiel
Docent(en)	dr. M. van de Wiel
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

Teaching students the adjustments to classical statistical methodology, necessary to tackle high-dimensional data.

Inhoud vak

This course gives an overview of statistical methods that are used for analyzing high-dimensional data sets in which many variables (often thousands) have been measured for a limited number of subjects. This type of data arises in genomics, where genetic information is measured for many thousands of genes simultaneously, in functional MRI imaging of the brain, and also in economic applications. The course covers some of the most important statistical issues for high-dimensional data, including: a) initial processing of the data; b) model-based statistical inference for Gaussian and count data (classical and Bayesian methods); c) multiple testing (family-wise error rate and false discovery rate control); d) prediction of binary endpoints (e.g. recurrence of a tumor) and survival; e) clustering of samples (e.g. to find tumor subtypes). Several specific types of high-dimensional data will be discussed and used during the course. In terms of applications the course focuses on cancer genomics, but theoretical aspects will apply to other fields as well.

Onderwijsvorm

Lectures + practical exercises

Toetsvorm

Written exam

Literatuur

Tutorial in biostatistics: multiple hypothesis testing in genomics" by Goeman & Solari (article in Statistics in Medicine) plus handouts provided by the lecturer

Aanbevolen voorkennis

Algemene statistiek, Statistical Data Analysis

Doelgroep

mMath, mSFM

Statistics for Networks

Vakcode	X_405110 ()
Credits	6.0

Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. M.C.M. de Gunst
Examinator	prof. dr. M.C.M. de Gunst
Docent(en)	prof. dr. M.C.M. de Gunst, dr. E.N. Belitser
Lesmethode(n)	Hoorcollege
Niveau	600

Doel vak

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

Inhoud vak

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

Onderwijsvorm

Lectures, presentations, homework assignments.

Toetsvorm

Assignments, presentations.

Literatuur

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

Vereiste voorkennis

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

Aanbevolen voorkennis

Statistical Data Analysis (X_401029)

Doelgroep

XM_MAT_S 1, XM_MAT_AG 1, XM_SFM

Overige informatie

This course will not be taught in the academic year 2017-2018.

Stochastic Differential Equations

Vakcode	X_400454 (400454)
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Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl>.

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

Stochastic Integration

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

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/31653>

Doelgroep

mMath, mSFM

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Stochastic Optimization

Vakcode	X_400336 (400336)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Coördinator	prof. dr. S. Bhulai
Examinator	prof. dr. S. Bhulai
Docent(en)	prof. dr. S. Bhulai
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

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

Inhoud vak

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

Onderwijsvorm

Lectures.

Toetsvorm

Programming and written exercises, final exam.

Literatuur

Lecture notes will be posted on Canvas.

Vereiste voorkennis

A programming language.

Aanbevolen voorkennis

Stochastische Processen (X_400646) and Wachtrijmodellen (X_401061) or equivalent courses on Stochastic Processes and Queueing Theory.

Doelgroep

mBA, mBa-D, mMath, mSFM.

Stochastic Processes

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

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl/>

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Stochastic Processes for Finance

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

Doel vak

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

Inhoud vak

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

A "stochastic process" is a collection of random variables, indexed by a set T . In financial applications the elements of T model time, and T is the set of natural numbers (discrete time), or an interval in the positive real line (continuous time). "Martingales" are processes whose increments over an interval in the future have zero expectation given knowledge of the past history of the process. They play an important role in financial calculus, because the price of an option (on a stock or an interest rate) can be expressed as an expectation under a so-called martingale measure. In this course we develop this theory in discrete and continuous time. Most models for financial processes in continuous time are based on a special Gaussian process, called Brownian motion. We discuss some properties of this process and introduce "stochastic integrals" with Brownian motion as the integrator. Financial processes can next be modeled as solutions to "stochastic differential

equations". After developing these mathematical tools we turn to finance by applying the concepts and results to the pricing of derivative instruments. Foremost, we develop the theory of no-arbitrage pricing of derivatives, which are basic tools for risk management.

Onderwijsvorm

Lectures and discussion of exercises

Toetsvorm

Assignments and written examination.

Literatuur

Lecture notes

Additional literature:

Shreve, "Stochastic Calculus for Finance I: The Binomial Asset Pricing Model", Springer;

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

Vereiste voorkennis

Probability (X_400622) and Analysis 1 (X_400005), or their equivalents.

Aanbevolen voorkennis

Measure Theory.

Doelgroep

mBA, mBA-D, mMath, mSFM, master Econometrics.

Overige informatie

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

Stochastic Simulation

Vakcode	XMU_0001 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2017-2018/zoek-vak/vak/33526>

Overige informatie

This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via <https://m.sis.uva.nl/vakaanmelden> is required.

Systems and Control

Vakcode	X_400332 (400332)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Examinator	prof. dr. B.W. Rink
Niveau	400

Inhoud vak

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

For schedules, course locations and course descriptions see

<https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

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<https://elo.mastermath.nl/login/>

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

TFT and moduli spaces

Vakcode	X_418073 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Examinator	prof. dr. G.J.B. van den Berg
Niveau	600

Inhoud vak

<http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/19428>

Doelgroep

mMath

Overige informatie

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

Time series

Vakcode	X_400571 (400571)
Periode	Periode 4+5

Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. B.W. Rink
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see <https://elo.mastermath.nl>.

Doelgroep

mMath

Intekenprocedure

You have to register your participation in each Mastermath course via <https://elo.mastermath.nl/login/>

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

Topology in Physics

Vakcode	XMM_0003 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	400