



Mathematics MSc

Vrije Universiteit Amsterdam - Faculteit der Exacte Wetenschappen - M Mathematics - 2013-2014

The master programme Mathematics offers the student a wide range of advanced mathematics courses. The students have a variety of options to specialize in a (sub)field of fundamental mathematics, or to choose subjects more broadly either with an eye towards applications or focused at a profession.

Reflecting these possibilities, there are several variants of the programme. In the *Research* (R) and *Professional* (P) variants, the students choose courses for 84 EC and complete their studies with a master project (R variant) or an internship (P variant) for 36 EC. The same applies to the *Biomedical* (B) variant, but in this variant at least 30 EC of the courses are to be chosen from the area of life sciences. The *Education* (E), *Society oriented* (S) and the *Communication* (C) variants consist of 36 EC Mathematics courses, a master project of 24 EC, and 60 EC dedicated to variant specific courses, projects and/or internships. Details about the compulsory courses in the different variants can be found in the study guide. In the R, P and B variants at most 15 EC can be devoted to optional courses, while the optional courses in the E, S and C variants are restricted to 12 EC.

At the start of every semester, students discuss their programme with the master coordinator. Mathematics courses can be selected from the 'local' courses offered by VU University Amsterdam and the University of Amsterdam, but also from the [MasterMath](#) programme offered jointly by the nine Dutch Universities that have a master programme in Mathematics or Engineering Mathematics. Students in the R and P variants are expected to follow at least 30 EC of these courses.

The master project is carried out under the supervision of a staff member of VU University Amsterdam or the University of Amsterdam. In case of an internship the student has a local advisor at the 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 R, P and B variants the student can only start the master project or internship after obtaining at least 75 EC.

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Biomedische variant

Opleidingsdelen:

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

Compulsory Choice

LERAREN VARIANT:

Optional Courses: it is compulsory to obtain at least 24EC

COMMUNICATION VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 36 EC

BIOMEDISCHE VARIANT:

Compulsory Optional Courses Mathematics: it is compulsory to obtain at least 30 EC

EDUCATION VARIANT:

Optional Courses: it is compulsory to obtain at least 24 EC

SOCIETY ORIENTED VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 24 EC

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

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
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 1	6.0	X_405041
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115

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
Elliptic Curves	Periode 1+2	8.0	X_400505
Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122
Functional Analysis	Semester 1	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Biology	Periode 4+5	8.0	X_400504
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024
Moduli Spaces	Periode 4+5	8.0	X_418117
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
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 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396

Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
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
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
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Variational Methods	Periode 1+2	8.0	X_400598
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

Compulsory Courses

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

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

Vakken:

Naam	Periode	Credits	Code
Master Project	Ac. Jaar (september)	36.0	X_400355
Scientific Writing in English	Periode 4	3.0	X_400512
Seminar Mathematics	Periode 1+2	6.0	X_405024

Communication variant

This specialization is intended for students with a BSc degree in any of the bèta-studies who want to specialize in communication. The programme focuses on science communication theory, research and practice. The

programme of the communication (C) specialization is 1 year (60 credits). This specialization may not be combined with the Societal specialization (M) or the Education specialization (E). C-courses are shared with master students from the Faculty of Earth and Life Sciences.

Programme

For a specialization degree it is required to spend 60 credits on Science Communication components. Two courses, one internship and a thesis are compulsory. The rest of the programme can be filled with optional courses. While science communication research is always a component of a student's internship, students have the opportunity to choose for placement at institutes such as newspapers, museums, science centers, companies, etc. to hone their practical as well as academic skills. Students' thesis comprise short (9 credits) literature studies on research questions about aspects of science communication.

To complete his or her entire Master programme (120 credits), the student has to choose 60 credits Mathematics courses. Before formal enrolment, the student's programme has to be approved by the master coordinator as well as the programme coordinator for the Science Communication.

Opleidingsdelen:

- [Compulsory Choice](#)
- [Compulsory selection 3 out of 4](#)
- [Compulsory Courses](#)

Compulsory Choice

LERAREN VARIANT:

Optional Courses: it is compulsory to obtain at least 24EC

COMMUNICATION VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 36 EC

BIOMEDISCHE VARIANT:

Compulsory Optional Courses Mathematics: it is compulsory to obtain at least 30 EC

EDUCATION VARIANT:

Optional Courses: it is compulsory to obtain at least 24 EC

SOCIETY ORIENTED VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 24 EC

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

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121

Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
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 1	6.0	X_405041
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115
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
Elliptic Curves	Periode 1+2	8.0	X_400505
Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122
Functional Analysis	Semester 1	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Biology	Periode 4+5	8.0	X_400504
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024
Moduli Spaces	Periode 4+5	8.0	X_418117
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124

Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
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 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
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
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
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Variational Methods	Periode 1+2	8.0	X_400598
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

Compulsory selection 3 out of 4

Vakken:

Naam	Periode	Credits	Code
Communication, Organization and Management	Periode 2	6.0	AM_470572
Science in Dialogue	Periode 2	6.0	AM_1002
Science Journalism	Periode 2	6.0	AM_471014
Science Museology	Periode 3	6.0	AM_470590

Compulsory Courses

Vakken:

Naam	Periode	Credits	Code
Internship Communication Specialisation	Ac. Jaar (september)	30.0	AM_471148
Master Project (for M,C,E-variant)	Ac. Jaar (september)	24.0	X_405037
Qualitative and Quantitative Research Methods	Periode 1	6.0	AM_470582
Science and Communication	Periode 1	6.0	AM_470587

Wiskunde

Opleidingsdelen:

- [Leraar voorbereidend hoger onderwijs in Wiskunde - verplichte vakken](#)
- [Compulsory Choice](#)
- [C/E/M-variant Compulsory Course Mathematics](#)

Leraar voorbereidend hoger onderwijs in Wiskunde - verplichte vakken

Vakken:

Naam	Periode	Credits	Code
Algemene didactiek en Pedagogiek I	Semester 1, Semester 2	6.0	O_MLADEPI
Algemene Didactiek en Pedagogiek II	Semester 1, Semester 2	3.0	O_MLADEPII
Praktijk I	Semester 1, Semester 2	15.0	O_MLPRAKI
Praktijk II	Semester 1, Semester 2	15.0	O_MLPRAKII
Professionele ontwikkeling en onderzoek I	Semester 1, Semester 2	3.0	O_MLVPOOI
Professionele ontwikkeling en onderzoek II	Semester 1, Semester 2	6.0	O_MLVPOOII
Vakdidactiek Wiskunde I	Semester 1, Semester 2	3.0	O_MLVDWII

Vakdidactiek Wiskunde II	Periode 1+2+3, Periode 4+5+6	6.0	O_MLVDWIII
Verdieping	Semester 1, Semester 2	3.0	O_MLVERD

Compulsory Choice

LERAREN VARIANT:

Optional Courses: it is compulsory to obtain at least 24EC

COMMUNICATION VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 36 EC

BIOMEDISCHE VARIANT:

Compulsory Optional Courses Mathematics: it is compulsory to obtain at least 30 EC

EDUCATION VARIANT:

Optional Courses: it is compulsory to obtain at least 24 EC

SOCIETY ORIENTED VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 24 EC

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

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
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 1	6.0	X_405041
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115
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
Elliptic Curves	Periode 1+2	8.0	X_400505

Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122
Functional Analysis	Semester 1	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Biology	Periode 4+5	8.0	X_400504
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024
Moduli Spaces	Periode 4+5	8.0	X_418117
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
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 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029

Statistical Models	Periode 1+2	6.0	X_400418
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
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
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Variational Methods	Periode 1+2	8.0	X_400598
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

C/E/M-variant Compulsory Course Mathematics

Vakken:

Naam	Periode	Credits	Code
Master Project (for M,C,E-variant)	Ac. Jaar (september)	24.0	X_405037

Professional Variant

Opleidingsdelen:

- [Compulsory Optional Courses - List A or B](#)
- [Compulsory Courses](#)

Compulsory Optional Courses - List A or B

It is compulsory to obtain at least 60 credits from the lists

- XM_MAT_K1 Math List A JNP

or

- XM_MAT_K2 Math List B VU/UvA

whereby a minimum of 30 credits are obtained from list A.

The student can obtain 15 credits at the most on optional courses.

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

Opleidingsdelen:

- [List A: Courses in the Joint National Programme MasterMath \(JNP\) \(30 EC required\)](#)
- [Lijst B: Courses taught at the VU or the UvA](#)

List A: Courses in the Joint National Programme MasterMath (JNP) (30 EC required)

These courses are 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>

Vakken:

Naam	Periode	Credits	Code
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115
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
Elliptic Curves	Periode 1+2	8.0	X_400505
Functional Analysis	Semester 1	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Biology	Periode 4+5	8.0	X_400504
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024

Moduli Spaces	Periode 4+5	8.0	X_418117
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
Operator Algebras	Periode 4+5	8.0	X_418062
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Processes	Periode 4+5	8.0	X_400339
Systems and Control	Periode 1+2	6.0	X_400332
Time series	Periode 4+5	8.0	X_400571
Variational Methods	Periode 1+2	8.0	X_400598

Lijst B: Courses taught at the VU or the UvA

Recommended elective Courses (45 EC)

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Coding and Cryptography	Periode 1	6.0	X_405041
Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122
Interest Rate Models	Periode 1+2	6.0	X_418091
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124

Optimization of Business Processes	Periode 4+5	6.0	X_400422
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
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
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

Compulsory Courses

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

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

Vakken:

Naam	Periode	Credits	Code
Master Project	Ac. Jaar (september)	36.0	X_400355
Scientific Writing in English	Periode 4	3.0	X_400512
Seminar Mathematics	Periode 1+2	6.0	X_405024

Research Variant

Opleidingsdelen:

- [Compulsory Optional Courses - List A or B](#)
- [Compulsory Courses](#)

Compulsory Optional Courses - List A or B

It is compulsory to obtain at least 60 credits from the lists

- XM_MAT_K1 Math List A JNP

or

- XM_MAT_K2 Math List B VU/UvA

whereby a minimum of 30 credits are obtained from list A.

The student can obtain 15 credits at the most on optional courses.

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

Opleidingsdelen:

- [List A: Courses in the Joint National Programme MasterMath \(JNP\) \(30 EC required\)](#)
- [Lijst B: Courses taught at the VU or the UvA](#)

List A: Courses in the Joint National Programme MasterMath (JNP) (30 EC required)

These courses are 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>

Vakken:

Naam	Periode	Credits	Code
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Category Theory and Topos Theory	Periode 4+5	8.0	X_418114
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115
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
Elliptic Curves	Periode 1+2	8.0	X_400505
Functional Analysis	Semester 1	8.0	X_400328

Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Biology	Periode 4+5	8.0	X_400504
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024
Moduli Spaces	Periode 4+5	8.0	X_418117
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
Operator Algebras	Periode 4+5	8.0	X_418062
Parallel Algorithms	Periode 1+2	8.0	X_418011
Partial Differential Equations	Periode 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Stochastic Differential Equations	Periode 4+5	6.0	X_400454
Stochastic Processes	Periode 4+5	8.0	X_400339
Systems and Control	Periode 1+2	6.0	X_400332
Time series	Periode 4+5	8.0	X_400571
Variational Methods	Periode 1+2	8.0	X_400598

Lijst B: Courses taught at the VU or the UvA

Recommended elective Courses (45 EC)

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Stochastic Modeling	Periode 1+2	6.0	X_400392
Coding and Cryptography	Periode 1	6.0	X_405041
Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122

Interest Rate Models	Periode 1+2	6.0	X_418091
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124
Optimization of Business Processes	Periode 4+5	6.0	X_400422
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
Statistics for High-Dimensional Data	Periode 4+5	6.0	X_405113
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
TFT and moduli spaces	Periode 4+5	6.0	X_418073
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

Compulsory Courses

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

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

Vakken:

Naam	Periode	Credits	Code
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Master Project	Ac. Jaar (september)	36.0	X_400355
Scientific Writing in English	Periode 4	3.0	X_400512
Seminar Mathematics	Periode 1+2	6.0	X_405024

Society Oriented variant

Opleidingsdelen:

- MSc Biology, Societal specialisation
- Compulsory Choice
- C/E/M-variant Compulsory Course Mathematics

MSc Biology, Societal specialisation

Courses:

Name	Period	Credits	Code
Analysis of Governmental Policy	Period 1	6.0	AM_470571
Business Management in Health and Life Sciences	Period 2	6.0	AM_470584
Clinical development and clinical trials	Period 3	6.0	AM_470585
Communication, Organization and Management	Period 2	6.0	AM_470572
Disability and Development	Period 2	6.0	AM_470588
Entrepreneurship in Health and Life Sciences	Period 2	6.0	AM_470575
Health, Globalisation and Human Rights	Period 2	6.0	AM_470818
Internship Societal Specialisation	Ac. Year (September)	30.0	AM_471147
Policy, Politics and Participation	Period 2	6.0	AM_470589
Qualitative and Quantitative Research Methods	Period 1	6.0	AM_470582
Science in Dialogue	Period 2	6.0	AM_1002

Compulsory Choice

LERAREN VARIANT:

Optional Courses: it is compulsory to obtain at least 24EC

COMMUNICATION VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 36 EC

BIOMEDISCHE VARIANT:

Compulsory Optional Courses Mathematics: it is compulsory to obtain at

least 30 EC

EDUCATION VARIANT:

Optional Courses: it is compulsory to obtain at least 24 EC

SOCIETY ORIENTED VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 24 EC

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

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
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 1	6.0	X_405041
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115
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
Elliptic Curves	Periode 1+2	8.0	X_400505
Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122
Functional Analysis	Semester 1	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116

Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Biology	Periode 4+5	8.0	X_400504
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024
Moduli Spaces	Periode 4+5	8.0	X_418117
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
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 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
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
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
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Variational Methods	Periode 1+2	8.0	X_400598
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

C/E/M-variant Compulsory Course Mathematics

Vakken:

Naam	Periode	Credits	Code
Master Project (for M,C,E-variant)	Ac. Jaar (september)	24.0	X_405037

Leraren variant

Opleidingsdelen:

- [Compulsory Choice](#)
- [Compulsory Choice of 6 ec](#)
- [Compulsory Courses](#)

Compulsory Choice

LERAREN VARIANT:

Optional Courses: it is compulsory to obtain at least 24EC

COMMUNICATION VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 36 EC

BIOMEDISCHE VARIANT:

Compulsory Optional Courses Mathematics: it is compulsory to obtain at least 30 EC

EDUCATION VARIANT:

Optional Courses: it is compulsory to obtain at least 24 EC

SOCIETY ORIENTED VARIANT:

Recommended Optional Courses: it is compulsory to obtain at least 24 EC

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

Vakken:

Naam	Periode	Credits	Code
Abelian Varieties	Periode 4+5	6.0	X_418121
Advanced Linear Programming	Periode 4+5	6.0	X_400326
Advanced Modelling in Science	Periode 4+5	6.0	X_400451
Algebraic Geometry	Periode 4+5	8.0	X_400456
Applied Analysis: Financial Mathematics	Periode 1+2	6.0	X_400076
Applied Finite Elements	Periode 4+5	6.0	X_400453
Applied Statistics	Periode 4+5	6.0	X_400452
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 1	6.0	X_405041
Continuous Optimization	Periode 1+2	6.0	X_400446
Continuum Mechanics	Periode 1+2	8.0	X_418115
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
Elliptic Curves	Periode 1+2	8.0	X_400505
Ergodic Theory with a View towards Number Theory	Periode 4+5	6.0	X_418066
Function Theory of Several Complex Variables	Periode 1+2	6.0	X_418122
Functional Analysis	Semester 1	8.0	X_400328
Heuristic Methods in Operations Research	Periode 1+2	6.0	X_418006
Infinite dimensional systems	Periode 4+5	6.0	X_418095
Interest Rate Models	Periode 1+2	6.0	X_418091
Introduction to Numerical Bifurcation Analysis of ODE's and Maps	Periode 4+5	8.0	X_418116
Levy fluctuation theory, with applications in finance and OR	Periode 1+2	6.0	X_418077
Levy processes and stochastic Volatility	Periode 4+5	6.0	X_418090
Lie Groups	Periode 4+5	8.0	X_400350
Mathematical Approaches to Quantum Field Theory	Periode 4+5	6.0	X_418123
Mathematical Biology	Periode 4+5	8.0	X_400504
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180

Measure Theoretical Probability	Periode 1+2	8.0	X_400244
Model Theory	Periode 4+5	6.0	X_437024
Moduli Spaces	Periode 4+5	8.0	X_418117
Nonparametric Bayesian Statistics	Periode 1+2	6.0	X_418124
Numerical Linear Algebra	Periode 1+2	8.0	X_400329
Numerical Methods for Stationary PDE's	Periode 4+5	8.0	X_418057
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 4+5	8.0	X_400330
Probabilistic and Extremal Combinatorics	Periode 1+2	8.0	X_418118
Quantum Groups and Knot Theory	Periode 1+2	6.0	X_400343
Queueing Theory	Periode 4+5	6.0	X_400397
Rational Points on Varieties	Periode 1+2	8.0	X_418119
Riemann Surfaces	Periode 1+2	8.0	X_400325
Scheduling	Periode 4+5	6.0	X_400396
Semiparametric Statistics	Periode 1+2	6.0	X_400605
Simulation Methods in Statistics	Periode 1+2	6.0	X_400258
Statistical Data Analysis	Periode 4+5	6.0	X_401029
Statistical Models	Periode 1+2	6.0	X_400418
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
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
Topics in stochastic networks	Periode 1+2	6.0	X_418089
Topological Methods for Nonlinear Differential Equations	Periode 1+2	6.0	X_400382
Toric Topology	Periode 1+2	6.0	X_405077
Variational Methods	Periode 1+2	8.0	X_400598
Workshop Mathematical Modelling	Periode 3	6.0	X_401062

Compulsory Choice of 6 ec

Vakken:

Naam	Periode	Credits	Code
Inleiding partiële differentiaalvergelijkingen	Periode 4+5	6.0	X_400163
Topologie 1	Periode 1+2	6.0	X_400416
Wiskundige analyse 2	Periode 4+5	6.0	X_400088

Compulsory Courses

Vakken:

Naam	Periode	Credits	Code
Algemene statistiek	Periode 1+2	6.0	X_400004
Complexe-functietheorie	Periode 1+2	6.0	X_400386
Gewone differentiaalvergelijkingen	Periode 1+2	6.0	X_400026
Master Project (for M,C,E-variant)	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

Abelian Varieties

Vakcode	X_418121 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/741908.html>

Doelgroep

mMath

Overige informatie

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

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
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; mBA

Advanced Modelling in Science

Vakcode	X_400451 (400451)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Algebraic Geometry

Vakcode	X_400456 (400456)
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
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

Doelgroep

mMath

Algemene didactiek en Pedagogiek I

Vakcode	O_MLADEPI ()
Periode	Semester 1, Semester 2
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	ir. E.J.F. Scheringa
Docent(en)	drs. W.S. Hoekstra, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, C.L. Geraedts
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak

De student kan algemene onderwijskundige en pedagogische inzichten op het terrein van (activerende) didactiek (rol van ontwerper), communicatie in de klas (rol van uitvoerder) en gedrag- en leerproblemen (verdiepende module) vertalen naar de eigen lespraktijk.

Inhoud vak

Deze module kent 4 onderdelen:

- de startweek (1 erts), waarin de student kennis maakt met de opleiding, met het basisinstrumentarium van een docent en de eigen startcompetenties in kaart brengt;
- colleges ten aanzien van de rol van Ontwerper en de rol van Uitvoerder;
- colleges over gedrag- en leerproblemen, waarin problematiek en aanpak van meest gangbare gedrag- en leerproblemen aan bod komen.

Onderwijsvorm

Colleges (hoorcolleges en werkgroepen)

Toetsvorm

- beoordeling van het portfolio
- tentamen over de colleges gedrag- en leerproblemen

Literatuur

Een literatuurlijst wordt verstrekt aan het begin van de opleiding

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding

Overige informatie

Voor alle onderdelen (startweek, rollen, verdiepende module) geldt een aanwezigheidsplicht

Algemene Didactiek en Pedagogiek II

Vakcode	O_MLADEPII ()
Periode	Semester 1, Semester 2
Credits	3.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	drs. B. Klein
Docent(en)	drs. H.R. Goudsmit, drs. B. Klein, dr. T. Bosma
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

De student kan:

1. leerlingen, als individu en als lid van de groep, ondersteunen en stimuleren in hun verdere persoons- en identiteitsontwikkeling;
2. de voorbeeldfunctie ten opzichte van leerlingen vormgeven en daarop reflecteren;
3. leerlingen helpen bij de voorbereiding op hun rol in de samenleving als actief participierend burger;
4. deze en eerdere verworven competenties aantonen in een showcaseportfolio

Inhoud vak

Deze module kent 2 onderdelen:

- colleges ten aanzien van de rol van Pedagoog;
- het werken aan de rolopdachten voor de rol van uitvoerder, ontwerper en pedagoog voor het showcaseportfolio;

Onderwijsvorm

Colleges (hoorcolleges en werkgroepen) en zelfstudie

Toetsvorm

- een tentamen betreffende de rol van Pedagoog
- beoordeling van het showcase portfolio, waarin de student de verworven competenties ten aanzien van alle rollen aantoont

Literatuur

Een literatuurlijst wordt verstrekt aan het begin van de opleiding, en staat op Blackboard bij de betreffende studieonderdeel

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding

Overige informatie

Voor de colleges geldt een aanwezigheidsplicht. Studenten die dit vooraf met de vakdidacticus/mentor overeengekomen zijn, kunnen in zelfstudie onderdelen afronden.

Algemene statistiek

Vakcode	X_400004 (400004)
Periode	Periode 1+2
Credits	6.0
Voertaal	Nederlands

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Docent(en)	dr. F. Bijma
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	200

Doel vak

Het college Algemene Statistiek is een eerste inleiding in de basisbegrippen van de mathematische statistiek. Na afloop van de cursus kan de student statistische modellen opstellen, verschillende soorten schatters bepalen, een aantal standaard toetsen opstellen en uitvoeren en betrouwbaarheidsgebieden construeren.

Inhoud vak

In de statistiek wil men op grond van waarnemingen uitspraken doen over de kansverdeling waaruit deze waarnemingen afkomstig zijn. In het college komen achtereenvolgens aan bod: statistische modellen, verdelingsonderzoek, schatten, toetsen, en het construeren van betrouwbaarheidsgebieden. Daarbij staan begripsvorming en de presentatie van enkele veel gehanteerde methoden centraal. De stof wordt geïllustreerd aan de hand van een aantal interessante praktijkvoorbeelden. We beperken ons in dit vak hoofdzakelijk tot de zogenaamde parametrische statistiek, dat wil zeggen dat de kansverdeling op één of meer parameters na bekend is.

Onderwijsvorm

Hoorcollege, werkcollege

Toetsvorm

Twee schriftelijke deeltentamens

Literatuur

Het boek "Inleiding in de Statistiek" van F. Bijma, M.A. Jonker, A.W. van der Vaart, Epsilon Uitgaven, 2013

Aanbevolen voorkennis

Studenten dienen de kennis van calculus en kansrekening paraat te hebben.

Doelgroep

2BA, 2WN, 2W, 2Ect

Analysis of Governmental Policy

Vakcode	AM_470571 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. J.T. de Cock Buning
Docent(en)	prof. dr. J.T. de Cock Buning
Lesmethode(n)	Hoorcollege, Werkgroep, Computerpracticum
Niveau	500

Doel vak

- To acquire critical knowledge regarding different policy models and theories
- To master the correct use of central concepts in political and policy discourses.
- To further deepen your analytic skills with respect to the critical assessment of a complex societal question or dilemma in the health and life science;
- To learn to integrate science- specific knowledge with the knowledge and skills of other disciplines of the social sciences
- To practice skills in data collection and analysis
- To learn to set up valid lines of argumentation;
- To learn to translate research findings into policy recommendations;
- To get experienced in writing a policy advisory report;
- To improve your communication skills;
- To improve your skills in working effectively in a project team, through team building, team analysis and feedback.

Inhoud vak

Governmental policy affects millions of people and is thus object of intensive debate and target of strong societal forces, like political parties, media and interest groups. Being an advisor or policy maker requires a thorough understanding of the dynamics of policy making, as well as from the psychological side as from the more social structures and their influence on a deliberative democracy.

The course contains several lectures on theoretical concepts and models concerning policy analysis. Furthermore you will be challenged, under supervision, to apply and practice these concepts and models in the project assignment. From the very first day, you will be part of a project team of about ten students. You are confronted with a real policy problem from an external commissioning institution (e. g. a non-governmental organization, a Ministry, an advisory council). Within those 4 weeks you will collect data by literature review and interviews and conduct an interdisciplinary analysis on the basis of which you provide an advice. Specific attention is paid to working in a project team and team building. At the end of the course, you prepare an advisory report. On the last day of the course you present the report to the representative of the external institution who commissioned the project. In that presentation your team will highlight the main results of your analysis and defend the recommendations you propose.

Onderwijsvorm

Analysis of Governmental Policy is a fulltime course of four weeks (6 ECTS). The most recent course schedule is to be found on Blackboard. The total study time is 160 hours. Tuition methods include lectures, training workshops, and self-study.

The different elements have the following study time:

- lectures: 15 hours
- project: 147 hours (within the project: 18x 1 hour coach meeting)
- self study: (within the project, defined in the group)
- examination: 2 hours

Please note that attendance to the project meetings is compulsory. Attendance to the lectures is highly recommended. In our experience, relying on self-study alone is insufficient to pass the exam

Toetsvorm

Written exam (25%) and individual evaluation based on personal performance in the project team (50%), and assessment of various group products (report and presentation (25%)). Exam has to be passed successfully.

Literatuur

Buse, Mays and Walt: "Making Health Policy" McGrawHill/Open University press. (at least 2nd edition 2012).

Aanbevolen voorkennis

The project integrates the learned lessons from the first compulsory MPA courses: Qualitative & Quantitative Methods.\

Doelgroep

Compulsory course within the Masterprogramme Management, Policy Analysis and entrepreneurship for the health and life sciences (MPA) and the Societal differentiation of Health, Life and Natural Sciences Masters programmes.

Overige informatie

The case is policy analysis and advice, but the exercised methods and skills are equally applicable to strategic marketing advice or evaluation studies. The teams will be coached by workgroup leaders.

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
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 oral 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

Overige informatie

It is possible to do some additional work by elaborating on a specific subject from the theory of partial differential equations or financial mathematics.

Applied Finite Elements

Vakcode	X_400453 (400453)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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>

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

Doelgroep

mMath

Overige informatie

Locatie: Universiteit Utrecht en Universiteit Twente.

Docent en eerste beoordelaar is Fred Vermolen (Technische Universiteit Delft).

Applied Statistics

Vakcode	X_400452 (400452)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Applied Stochastic Modeling

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

Doel vak

To learn the most often used stochastic models and how they are applied in practice.

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: birth-death-processes, basic queueing models, inventory models, renewal theory and simulation. We also repeat and extend certain parts of probability theory. We end with an overview of mathematical modeling, including aspects such as the economic context, the choice of solution method, decision support systems, etc.

Onderwijsvorm

Hoor- en werkcollege.

Toetsvorm

Written examination.

Literatuur

Lecture notes.

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

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

Business Management in Health and Life Sciences

Vakcode	AM_470584 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. H.J.H.M. Claassen
Docent(en)	prof. dr. H.J.H.M. Claassen
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak

To acquire insight in different legal entities in which to organise a company or enterprise

To get acquainted with:

- financial and legal aspects
- patents and alternative valorization methods
- marketing and sales aspects of businesses

To acquire insight in Human Resource Management models

To get acquainted with different models of financing

To learn to think and act in line with economic and sustainability issues for the company

Inhoud vak

Increasingly, health students will be confronted with a corporate way of thinking in health organisations. To function in such an environment it is critical that students have basic knowledge of fiscal and legal entities and organisational forms of corporate structures (including start-ups). Furthermore, they have to understand what motivates decision makers and financial officers in different companies (also geographical differences). This course comprises a theoretical and a practical part. The theoretical part consists of interactive classes with various experts from the field. Topics that will be dealt with in detail include: intellectual property, portfolio management, finance, risk capital, grants and subsidies, team building and people management, different legal entities, fiscal and legal aspects when

starting a new company, SWOT analysis in the life sciences and clinical trials. The practical part consists of bringing the knowledge acquired during the classes into practice in an assignment in which you develop a (personal career) businessplan.

Onderwijsvorm

Lectures:35h

Assignment: 4h

Work on assignment (self study): 40h

Preparing the exam: 81h

Toetsvorm

Written exam: 50%

Personal Business Plan: 50%

Both have to be passed

Literatuur

Will be announced on Blackboard 1 month before the start of the course

Doelgroep

Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life Sciences (MPA), Societal differentiation of the Health, Life & Natural Sciences.

Overige informatie

Guest lecturers/organisations:

- Robert Al, TU Eindhoven
- Tamar Weenen, VU university
- Esther Pronker, VU university
- Patrick de Boer & Jochem Bosschenbroek, Ttopstart BV
- Bart van Weezenbeek
- Bart Bergstein, Forbion Capital partners
- Michael Mellink & Majorie Soeter, Odgersberndtson
- Marga Janse, innovatief LerenLeren BV
- NL Octrooicentrum
- Price Waterhouse Coopers
- AsjesBisseling Belastingadviseurs
- And others to be announced

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
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>.

Clinical development and clinical trials

Vakcode	AM_470585 ()
Periode	Periode 3
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	W.S. Konijn MSc
Docent(en)	prof. dr. H.J.H.M. Claassen
Lesmethode(n)	Hoorcollege, Computerpracticum, Werkgroep
Niveau	500

Doel vak

To acquire knowledge and insight into the role and objectives of drug and clinical development process

To acquire knowledge and insight into the clinical pharmacology in drug development, drug interactions, pharmacodynamic and metabolic interactions

To acquire knowledge and insight into clinical study methodology

To acquire knowledge and skills into the regulatory principles

To acquire knowledge of ICH-GCP and quality

To acquire knowledge and insight into clinical trial coordination

To acquire knowledge and skills into the data management and statistics.

To acquire insight into the ethical aspects

To acquire insight into actual use of clinical trials in R&D strategies

To learn to design a clinical study

To acquire insight into the different epidemiologic study designs

To acquire knowledge and skills into how exposure and disease in a population can be measured and how the relationships between them can be assessed (using SPSS)

To acquire knowledge and skills into interpreting and presenting the results of an epidemiologic study

Inhoud vak

The need for rigorous evaluation of components of health care is increasingly recognised worldwide. An important type of evaluation is the clinical trial. The most commonly performed clinical trials evaluate new drugs, medical devices, biologics, or other interventions on patients in strictly scientifically controlled settings, and are required for regulatory authority approval of new therapies. This course aims to provide students with a theoretical and practical understanding of the issues involved in the design, conduct, analysis and interpretation of clinical trials of health interventions. Furthermore classes are provided on which the actual use of clinical trials in day to day R&D strategies within industry and universities is addressed in detail. Classes include: 'Life Cycle of a Clinical Trial', 'Clinical Trial Methodology', 'ICH-GCP Principles', 'The Ethics Committee', 'Safety Considerations in Clinical Trials', 'Quality Control & Quality Assurance', 'Compliance, Misconduct & Fraud'.

An additional week of basic epidemiology will help you to complement the knowledge obtained so far in the course with an understanding of the principles of other types of study designs (cross-sectional, longitudinal, case-control). Issues concerning exposure and disease measurement and exposure-disease relationships will be discussed in detail, and examples will be provided. Together with your colleagues, you will learn how to apply this knowledge first by hand (during the

lectures), then to an epidemiologic database (during the computer-based sessions) and how to interpret the results critically.

Onderwijsvorm

Lectures: 25h
(Computer) workgroup: 32h
Preparing the exam: 2h

Toetsvorm

Written exam: 100%

Literatuur

Will be announced on Blackboard 1 month before the start of the course

Doelgroep

Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life Sciences (MPA), Societal differentiation of the Health, Life & Natural Sciences.

Overige informatie

Guest lecturers/organisations:

- Eric Klaver
- DOCS
- Others to be announced

Coding and Cryptography

Vakcode	X_405041 (405041)
Periode	Periode 1
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

To give an introduction the theory of error correcting codes and to cryptography.

Inhoud vak

This course provides a thorough introduction to the theory of error correcting codes, and to 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. For cryptography we discuss some modern public key cryptography (e.g., RSA, ElGamal, DSA).

Onderwijsvorm

Lectures and exercise classes

Toetsvorm

Written exam and homework

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, on the integers modulo n , and on polynomials.

Doelgroep

mAI, mCS, mMath, mPDCS

Communication, Organization and Management

Vakcode	AM_470572 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. J. Maas
Docent(en)	dr. H. Wels, prof. dr. F. Scheele, dr. M.B.M. Zweekhorst
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

- To get acquainted with theories on organisational behaviour
- To obtain a deeper understanding of communication from the perspective of sharing and influencing results
- To acquire knowledge on organisational structures and designs
- To get acquainted with important theories on organisational transitions and change management
- To acquire insight into different management practices in the health and life sciences sector
- To gain insight in leadership and interpersonal behaviour
- To obtain insight in methods for motivation and conflict management
- To improve communication skills
- To practise analytical and advisory skills

Inhoud vak

Organisations in the health and life science sector are changing fast, a phenomenon driven by newly emerging technologies and increasing societal complexity. A growing number of students with a beta degree will hold professional and managerial functions in these organisations. During this course students will learn how to be effective performers within these environments, both individually and in teams. This requires an understanding of the macro aspects of organisational behaviour, including designing organisations, managerial skills and ways of strategic thinking. Several speakers conduct lectures on aspects as motivation, managing interpersonal behaviour, leadership, communication and developing and changing organisations. The speakers explain theories from literature and relate them to their practical experiences. In addition, the students interview managers in health organisations and analyse these interviews using the newly acquired theoretical concepts.

Also, practical cases of health care companies will be analysed and discussed, resulting in advisory reports for management. With the other students you discuss your experiences and a coach helps you relate the experiences to theory.

Onderwijsvorm

Lectures (approximately 22 hours), response lectures (4 hours), self study, training workshops (12 hours), self-study and writing project assignment (approximately 120 hours).

Toetsvorm

Written exam (60%;) and assessment of the interviews, case study analysis, and reports (40%). Grades of both parts must at least be 6 or higher.

Literatuur

To be announced on Blackboard

Doelgroep

Compulsory course within the Master programme Management, Policy Analysis and Entrepreneurship for the Health and Life Sciences (MPA) and the Societal differentiation of Health, Life and Natural Sciences Masters programmes

Overige informatie

Attendance to training, workshops, interviews and discussions is indispensable

Complexe-functietheorie

Vakcode	X_400386 (400386)
Periode	Periode 1+2
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. J.J. Dijkstra
Lesmethode(n)	Hoorcollege, Werkcollege
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. De eerste helft van de cursus wordt gegeven voor wiskunde en natuurkunde studenten. De tweede helft is theoretischer van aard.

Inhoud vak

Tijdens het college worden de volgende onderwerpen behandeld:

- elementaire eigenschappen van analytische functies
- conforme afbeeldingen en harmonische functies
- complexe integratie en de stelling en integraalformule van Cauchy
- formulering en bewijzen met windingsgetallen
- singulariteiten, Laurent-ontwikkeling, residuenstelling
- meerwaardige functies

- toepassingen op gewone integralen

Onderwijsvorm

College en werkcollege.

Toetsvorm

Schriftelijk, met deeltentamens aan het einde van perioden 1 en 2.

Literatuur

Complex Variables and Applications (8th edition) van James Ward Brown en Ruel V. Churchill, uitgever: Mc Graw Hill, ISBN 007-126328-4.

Doelgroep

2W, 2WN

Continuous Optimization

Vakcode	X_400446 (400446)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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;mBA

Continuum Mechanics

Vakcode	X_418115 ()
Periode	Periode 1+2
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 <http://www.mastermath.nl>.

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

Doelgroep

mMath

Differential geometry

Vakcode	X_400509 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Pasquotto
Docent(en)	dr. F. Pasquotto
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

Understand geometric structures on differentiable manifolds

Inhoud vak

In the first part of this course we will offer a panorama of different geometric structures, such as complex structures, symplectic structures, contact structures, foliations, regular Poisson structures... We will do so starting at an introductory level, but ultimately aim at describing some interesting features or applications of each one of these structures. In the second part of the course we will make a step towards unifying these concepts and discuss the notion of SG -structures, using all the previous examples as illustrations.

Onderwijsvorm

Lectures and assisted exercise sessions

Toetsvorm

Take home exercises and final exam

Literatuur

n.n.b.

Aanbevolen voorkennis

Multivariable analysis, manifolds and differential forms, group theory

Doelgroep

mMath

Overige informatie

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

For schedules, course locations and course descriptions see

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

Disability and Development

Vakcode	AM_470588 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels

Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. W.H. van Brakel MD
Docent(en)	H.B. Miranda Galarza MSc, F.M. Budge MSc
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

- To develop an understanding of disability and the issues faced by people with disabilities
- To develop knowledge and skills for disability research, policy development and management related to disability, rehabilitation and development
- To acquire insight into the epidemiology of disability, with separate attention for important determinants like gender, poverty and HIV/AIDS
- To learn how to use relevant models of disability and the conceptual framework of the International Classification of Functioning, Disability and Health (ICF)
- To understand the importance of human rights in relation to disability and to learn to use the UN Convention for the Rights of Persons with Disabilities for advocacy and other rights-based interventions
- To acquire skills and knowledge in measurement and research methods relevant to disability
- To understand the importance of inter-sectoral collaboration
- To gain insight in participatory approaches

Inhoud vak

The Disability and Development (D&D) course focuses on a broad range of issues related to disability and rehabilitation in the context of development. This means that the focus is on people with disabilities in low and middle-income countries. Disability affects an estimated 1 billion people worldwide, the majority of whom live in low and middle-income countries. The large majority are poor and have no access to rehabilitation services; neither are facilities in place to allow them to be included in the mainstream of society.

To date, very few services and programmes are available to address these needs. The realisation that the Millennium Development Goals cannot be met without addressing the needs of people with disability has brought a new impetus to the field of disability and development. Another major recent development was the adoption of the UN Convention on the Rights of Persons with Disabilities in December 2006. It is expected that there will be a substantial increase in demand for training of a large variety of professionals (e.g. researchers, managers, architects, lawyers, health professionals) with formal training and qualifications in the field of disability-inclusive development.

This rapidly increasing interest in disability, as a development and human rights issue, means that this emerging field of study will rapidly gain in importance and should become part of any serious higher education programme in social and development studies and in international public health. The course will cover essential knowledge and skills in this subject.

The 4-week course programme will include the following subjects:

- Disability models and stereotypes,

- Frequencies and distribution of disability,
- Experience of having a disability,
- ICF conceptual framework,
- Disability rights, including the UN Convention on the Rights of Persons with Disabilities,
- Culture and disability,
- Determinants of disability, including stigma and discrimination, poverty, gender and HIV/AIDS,
- Measurement of disability,
- Disability-relevant research methods, including survey methods, examples of disability research
- An introduction to community-based rehabilitation.

Onderwijsvorm

Problem-based learning supported by lectures and an article writing assignment

The programme comprises 168 study hours, divided as follows:

- Lectures: 36
- Tutorial groups: 18
- Other events: 12
- Self-study: 102

Toetsvorm

Participation in tutorial groups: 10%

Take-home examination, submitted electronically: 60%

Scientific article: 30%

Literatuur

See e-reader

Vereiste voorkennis

Bachelor-level education; any subject

Doelgroep

The Disability & Development module is an optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life Sciences (MPA), International Public Health and Biomedical Sciences; external students from low and middle-income countries are strongly encouraged to apply. We encourage the participation of students with disabilities, especially from low and middle-income countries.

Overige informatie

Jacqueline Kool, MA

Lydia la Rivière-Zijdel, MA

Discrete Optimization

Vakcode	X_400445 (400445)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Dynamical Systems

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

Doel vak

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

Inhoud vak

Subjects that will be treated in detail are:

- Dynamics near equilibria and periodic orbits: linearization, local stability, Floquet theory.
- Topological dynamics: limit sets, transitivity, Poincare-Bendixon.
- Bifurcation theory: normal forms, Lyapunov-Schmidt reduction, saddle-node, period-doubling and Hopf bifurcation.
- Invariant manifolds: stable manifold theorem, center manifolds.
- Hyperbolic dynamics: Smale horseshoe, basic sets, structural stability.

Onderwijsvorm

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

Toetsvorm

Two homework assignments (25% each) and a final written exam (50%).

Literatuur

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

Aanbevolen voorkennis

A BSc course on Dynamical Systems or Ordinary Differential Equations. Basics concepts of topology.

Doelgroep

Overige informatie

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 is also required via <http://www.mastermath.nl>.

Elliptic Curves

Vakcode	X_400505 (400505)
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

Overige informatie

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>.

Entrepreneurship in Health and Life Sciences

Vakcode	AM_470575 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. E. Masurel
Docent(en)	prof. dr. E. Masurel
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

Students obtain knowledge about and insight in the relevance of entrepreneurship and innovation for their own discipline. Students learn about the processes which are involved in the recognition and exploitation of opportunities, about creating economic and social value

and about the nature and role of networks. In addition students gain knowledge of different entrepreneurial processes and the importance of valorisation of (bio)medical findings and business ideas for a knowledge-based economy.

Learning objectives

- Become familiar with an innovation outlook on entrepreneurship.
- Become aware that value-adding opportunities not only contain financial aspects but also social and ecological aspects (sustainable entrepreneurship).
- Gain the ability to write a feasibility plan on how to bring an innovation to the market.
- Obtain knowledge about and insight in the relevance of entrepreneurship and innovation for science disciplines.
- Learn about the processes which are involved in the recognition and exploitation of opportunities, about creating economic and social value and about the nature and role of networks.
- Gain knowledge of different entrepreneurial processes and the importance of valorisation of (bio)medical findings and business ideas for a knowledge-based economy.

Inhoud vak

This course consists of two tracks: a theoretical track and a practical track. These two tracks run simultaneously. In the first track you learn about entrepreneurship. Answers are found on questions such as: What is entrepreneurship? What defines an entrepreneur? What are entrepreneurial opportunities? What is the role of innovation in entrepreneurship? What is corporate social responsibility (CSR)? How can we judge the feasibility of entrepreneurial ambitions? Simultaneously you work on an assignment (second track). In the first week of this course you search for an innovation in your own discipline (product, service, process etc). Your choice must be approved by the lecturers. The first part of the assignment consists of a description of the innovation which you have chosen. Subsequently, you make a SWOT-analysis and a network analysis of the innovation. Also a paragraph on CSR aspect should be added. The final part of the assignment is your own feasibility study: how would you valorize the innovation to the market?

Onderwijsvorm

Lectures, personal meetings. Each week scientific lectures are given (on entrepreneurship, SWOT-analysis, innovation, CSR etc). These lectures are both the basis for the exam and for the assignment. Each week the student has a short meeting with his / her supervisor, in order to discuss the progress of his/her assignment.

Schedule and study time

The total study time is 160 hours.

Tuition methods include lectures, consultancies and self-study.

The different elements have the following study time:

- lectures 18 hours
- consultancies 8 hours
- writing feasibility plan 65 hours
- self study 65 hours
- examination 4 hours

Toetsvorm

You conduct a written exam and an assignment. Both the exam and the assignment determine 50% of the grade. The exam and the assignment must be of sufficient quality.

Literatuur

To be announced on Blackboard

Doelgroep

Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life sciences (MPA), M-differentiation of the Health, Life & Natural Sciences, Biology, Biomedical Sciences.

Overige informatie

Attendance is compulsory. Prior knowledge: Business Management in Health and Life sciences. For information and application:

anna.van.luijn@falw.vu.nl

Ergodic Theory with a View towards Number Theory

Vakcode	X_418066 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/en/c/11957.html>

Doelgroep

mMath

Overige informatie

Registration is required via <https://www.sis.uva.nl> until four weeks before the start of the semester.

Function Theory of Several Complex Variables

Vakcode	X_418122 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/8098.html>

Doelgroep

mMath

Overige informatie

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

Functional Analysis

Vakcode	X_400328 (400328)
Periode	Semester 1
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

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

Doelgroep

mMath

Gewone differentiaalvergelijkingen

Vakcode	X_400026 (400026)
Periode	Periode 1+2
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. B.W. Rink
Docent(en)	dr. B.W. Rink
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	300

Doel vak

Het leren van de theorie en praktijk van niet-lineaire gewone differentiaalvergelijkingen.

Inhoud vak

Dit college is gewijd aan de theorie van niet-lineaire differentiaalvergelijkingen. Aan de orde komen existentie en uniciteit van oplossingen, methoden voor het expliciet berekenen van oplossingen en kwalitatieve aspecten van de oplossingsverzameling. Aan de hand van een aantal concrete voorbeelden wordt geïllustreerd hoe men dergelijke problemen aanpakt.

Onderwijsvorm

De cursus wordt gegeven in college- en werkcollegevorm, waarbij een aanwezigheidsplicht geldt.

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%. Tevens dient

de student bij 75% van alle colleges en werkcolleges aanwezig te zijn geweest.

Literatuur

Steven Strogatz, "Nonlinear dynamics and chaos: with applications to physics, biology, chemistry and engineering", paperback edition, Westview Press, 1st ed, 2001

Aanbevolen voorkennis

Eerstejaars cursussen Calculus en Analyse

Doelgroep

2W, 2W-B, 2-WN, 3BA, mBA, CHW-doorstroom

Overige informatie

Actuele informatie over dit vak kan worden gevonden op Blackboard.

Health, Globalisation and Human Rights

Vakcode	AM_470818 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. C.W.M. Dedding
Docent(en)	prof. dr. P. Heutink, dr. M.G.B.C. Bertens
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

To acquire knowledge and understanding of the relationship between global public health issues and the global protection of human rights
To analyse how violations of human rights affect health and well-being
To learn methods of human rights assessment in relation to innovations in health technology
To acquire insights into the cultural dimensions of human rights values in relation to public health

Inhoud vak

This course focuses on the human rights issues that are raised around the globe in connection with public health concerns. The course introduces the students to the effects of globalization on health issues, to the relevant UN human rights instruments on health and to the mechanisms to promote and protect these rights. Attention is given to a wide range of human rights topics in which health and well being play a crucial role. Examples are situations of armed conflict, reproductive rights, migration and refugee issues and childrens rights. Within the context of current globalisation processes the importance of local cultural insights into the human rights & public health interaction will be discussed. During the course students will prepare and participate in a simulation on a human rights assessment of innovations in health technology and discuss relevant scientific literature in study groups. In the exam students will show their creative problem-solving skills applying them to human rights dilemmas in public health.

Onderwijsvorm

Contact hours

Lectures: 33 hours

Work groups: 10 hours

Group project, simulation and exam: 8 hours

Self study and preparing: remaining hours

Toetsvorm

Group project (10%), Simulation (20%), exam (70%). All parts need to be passed (6.0)

Literatuur

To be announced at the start of the first work group/lecture

Doelgroep

Optional course for students in all differentiations of the Masters Health Sciences, Biomedical Sciences and Management, Policy Analysis and Entrepreneurship in Health and Life Sciences.

Overige informatie

Guest lectures and guest organisations (under reservation):

Christine Dedding (Children and rights)

Fiona Budge (Culture and Health)

Bert Keizer (Elderly Rights)

Els Mons (Rights and disabled persons)

Women on Waves

Doctors without Borders

And more to be announced.

For more information contact Anna van Luijn: a.van.luijn@vu.nl

Heuristic Methods in Operations Research

Vakcode	X_418006 (418006)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Infinite dimensional systems

Vakcode	X_418095 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Niveau	500

Doel vak

Introduction to the theory of infinite dimensional systems.

Inhoud vak

The course covers the largest part of the book
Linear Port-Hamiltonian Systems on Infinite-dimensional Spaces,
by Birgit Jacob and Hans J. Zwart. Birkhäuser, 2012.

First finite dimensional systems theory is repeated with a focus on introducing port-Hamiltonian systems, then the theory of strongly continuous semigroups is treated. The theory is applied to several important examples involving the modeling of boundary control problems for systems whose dynamics is governed by partial differential equations.

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> .

Onderwijsvorm

Lectures

Toetsvorm

Homework only

Literatuur

Linear Port-Hamiltonian Systems on Infinite-dimensional Spaces,
by Birgit Jacob and Hans J. Zwart. Birkhäuser, 2012.

Aanbevolen voorkennis

Analysis, differential equations, preferably also a first course in mathematical systems theory.

Doelgroep

Master students in mathematics, physics, engineering.

Inleiding partiële differentiaalvergelijkingen

Vakcode	X_400163 (400163)
Periode	Periode 4+5
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Hulshof
Docent(en)	prof. dr. J. Hulshof

Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

The majority of physical phenomena can be described by partial differential equations. This module discusses these equations and methods for their solution. For first order equations we discuss the method of characteristics and the solution by methods of ordinary differential equations. For second order equations, in particular for the heat and wave equation we discuss the method of separation of variables. This ties in with the remarkable result of Fourier that almost any periodic function can be represented as a sum of sines and cosines, called its Fourier series. An analogous representation for non-periodic functions is provided by the Fourier transform, to be discussed briefly in part 2, as well as some theoretical background for Fourier series. In Part 2 we discuss some of the background for generalised Fourier series: the role of eigenvalue problems and some basic spectral theory. Potential methods and fundamental solutions will be discussed for the standard examples: heat, wave and Poisson equation. Harmonic functions will be discussed in relation to mean value properties.

Inhoud vak

Part 1: - Classical examples - First order equations and characteristics - d'Alembert's solution for the wave equation - Separation of variables for second order equations - Fourier Series - Fundamental solutions for heat and wave equation in one spatial dimension - The Dirac delta-function.

Part 2 - Fourier theory - Laplace and Poisson equation through potential methods - Eigenvalue problems and some spectral theory - Special functions (Bessel functions) - Harmonic functions - Fundamental solutions in 2 and 3 spatial dimensions

Onderwijsvorm

Course and exercise class

Toetsvorm

Two written exams and incidental homework

Literatuur

Peter J. Olver, "Introduction to Partial Differential Equations". Springer-Verlag, New York, 2014. ISBN 978-3-319-02099-0

Aanbevolen voorkennis

Calculus, in particular vectorcalculus, Gauss divergence Theorem and Green's formulas

Doelgroep

2WN, 3W, mMath

Overige informatie

The first part of the course is also taken by the Physics Students.

Interest Rate Models

Vakcode	X_418091 ()
Periode	Periode 1+2

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

Inhoud vak

The course description is available on:

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

Doelgroep

mSFM, mMath

Overige informatie

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

Internship Communication Specialisation

Vakcode	AM_471148 ()
Periode	Ac. Jaar (september)
Credits	30.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. R.J. van Belle-van den Berg
Niveau	600

Internship Societal Specialisation

Vakcode	AM_471147 ()
Periode	Ac. Jaar (september)
Credits	30.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. R.J. van Belle-van den Berg
Niveau	600

Introduction to Numerical Bifurcation Analysis of ODE's and Maps

Vakcode	X_418116 ()
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 <http://www.mastermath.nl>.

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

Doelgroep

mMath

Levy fluctuation theory, with applications in finance and OR

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

Inhoud vak

The course description is available on:

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

Doelgroep

mSFM

Overige informatie

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

Levy processes and stochastic Volatility

Vakcode	X_418090 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/8873.html>

Doelgroep

mSFM

Overige informatie

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

Lie Groups

Vakcode	X_400350 ()
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 <http://www.mastermath.nl>.

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

Doelgroep

mMath

Overige informatie

Docent en eerste beoordelaar is Erik van den Ban (Universiteit Utrecht).

Master Project

Vakcode	X_400355 (400355)
Periode	Ac. Jaar (september)
Credits	36.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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 on the form that can be downloaded here: <http://www.few.vu.nl/en/current-students/study-guidance-and-contact/final-assessment-form/index.asp> (a copy is given to the master coordinator). The project itself usually starts with a literature study, leads towards the boundaries of mathematical knowledge, and ideally culminates in original research by the student. The work is carried out by the student individually, while there are weekly or biweekly meetings

with the supervisor to discuss progress and scientific questions. The work is presented both in a master thesis and in a colloquium talk (mandatory).

Onderwijsvorm

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

Toetsvorm

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

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/int-car/internships/index.asp>

Master Project (for M,C,E-variant)

Vakcode	X_405037 (405037)
Periode	Ac. Jaar (september)
Credits	24.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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.

Onderwijsvorm

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

Toetsvorm

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

Literatuur

assigned individually

Vereiste voorkennis

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

Doelgroep

mSFM, 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/int-car/internships/index.asp>

Mathematical Approaches to Quantum Field Theory

Vakcode	X_418123 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/741912.html>

Doelgroep

mMath

Overige informatie

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

Mathematical Biology

Vakcode	X_400504 ()
Periode	Periode 4+5
Credits	8.0
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Planque
Docent(en)	dr. R. Planque

Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

This is a master course for math students about mathematical methods to gain insight in the mechanisms underlying biological phenomena.

In the course, a lot of attention is paid to "translation": how do we get from biological information to a mathematical formulation of questions? And what do the mathematical results tell us about biological phenomena?

In addition, the course aims to introduce general physical ideas about time scales and spatial scales and how these can be used to great advantage when performing a mathematical analysis.

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.

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

Mathematical Systems and Control Theory

Vakcode	X_400180 (400180)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.C.M. Ran
Docent(en)	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

The course aims to introduce the student to the mathematical theory of control systems.

Inhoud vak

Many phenomena are characterized by dynamic behaviour where we are interested in a certain input/output behaviour. Examples are to be found in the exact and natural sciences (mechanics, biology, ecology), in engineering (air- and spacecraft design, mechanical engineering) as well as in economics and econometrics (macro- economical models, conjuncture, trend and seasonal influences in demand and supply, production systems). Systems theory is concerned with modeling, estimation and control of dynamical phenomena. During the course the following subjects will be treated: models and representations (linear systems, input-output, state space, transfer function, stochastic systems, spectrum), control (stabilisation, feedback, pole placement, dynamic programming, the LQ problem), and identification and prediction (parameter estimation, spectral analysis, Kalman- filter, model reduction). Applications are in the area of optimal control and prediction.

Onderwijsvorm

There is a lecture of two hours each week. In addition, there is another session which will be half lecture and half practicum, in which there is the possibility to ask questions about the compulsory computerpracticum.

The practicum makes use of the Matlab package.

Toetsvorm

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

Literatuur

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

Aanbevolen voorkennis

Analysis, probability theory, statistics.

Complex analysis and Fourier theory would be useful, but are not absolutely necessary.

Doelgroep

3W, mBA, mMath

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

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
Docent(en)	prof. dr. R.W.J. Meester
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

Inhoud vak

We start by explaining why the Riemann integral is not completely satisfactory. Then we continue by developing the notion of the Lebesgue measure of a subset of the real numbers, for as many subsets as possible. This measure extends the usual length of an interval, and its construction, via null sets and outer measure, is useful in abstract situations as well. Once we have defined measure, we can introduce and discuss so called measurable functions which, roughly speaking, form the class of functions which we will be able to integrate. We then introduce and study integration of these measurable functions with respect to a measure. We discuss (among other things) the monotone and dominated convergence theorems concerning the interchangeability of limit and integral, the substitution rule, absolute continuity and the relation of this new integral to the Riemann integral. We also discuss multi-dimensional Lebesgue measure, product measures and Fubini's theorem. We will also discuss the Radon-Nikodym theorem. The theory leads to a new perspective on integration of functions, which is not only more general when working on the real line, but also allows one to develop the concept of integration in an abstract setting. This is of crucial importance for the development of (for example) functional analysis and probability theory.

Onderwijsvorm

Classical classes with exercise classes.

Toetsvorm

Written exam, with an intermediate exam after 7 weeks.

Literatuur

Marek Capinski and Ekkehard Kopp: Measure, Integral and Probability, second edition (Springer).

Vereiste voorkennis

Basics of calculus.

Doelgroep

3W, 3Ect, 3WN

Model Theory

Vakcode	X_437024 (437024)
Periode	Periode 4+5
Credits	6.0
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 descriptions and locations see

<http://www.mastermath.nl>

Doelgroep
mMath

Moduli Spaces

Vakcode	X_418117 ()
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

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

Nonparametric Bayesian Statistics

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

Inhoud vak

The course description is available on:
<http://studiegids.uva.nl/web/uva/sgs/nl/c/7984.html>

Doelgroep
mMath, mSFM

Overige informatie

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

Numerical Linear Algebra

Vakcode	X_400329 (400329)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Numerical Methods

Vakcode	X_401039 (401039)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. R. Planque
Docent(en)	dr. R. Planque
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	300

Doel vak

- Gain experience in numerically solving a variety of problems.
- Getting acquainted with methods from numerical analysis.
- Develop intuition for the reliability of numerical methods.
- Learn how to use matlab.

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

Literatuur

Alfio Quarteroni, Fausto Saleri and Paola Gervasio, Scientific Computing with Matlab and Octave. Springer-Verlag, 2010, 3rd edition, ISBN 9783642124297

Vereiste voorkennis

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

Aanbevolen voorkennis

A basic course in linear algebra.

Doelgroep

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

Numerical Methods for Stationary PDE's

Vakcode	X_418057 (418057)
Periode	Periode 4+5
Credits	8.0
Faculteit	Faculteit der Exacte Wetenschappen
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

Operator Algebras

Vakcode	X_418062 ()
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

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

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

Doelgroep

mMath

Optimization of Business Processes

Vakcode	X_400422 (400422)
Periode	Periode 4+5
Credits	6.0

Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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 few application areas, especially in 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.

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. 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

Partial Differential Equations

Vakcode	X_400330 (400330)
Periode	Periode 4+5
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Policy, Politics and Participation

Vakcode	AM_470589 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. J.T. de Cock Buning
Docent(en)	dr. B.J. Regeer, dr. J.F.H. Kupper, prof. dr. J.E.W. Broerse
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

To further deepen your analytic skills with respect to the assessment of a specific societal problem;

To acquire further insight into the practice of interactive research;

To acquire further insights into specific methods and techniques of interactive research;

To strengthen the skills to design an interactive research project

To practice skills in data collection and analysis;

To learn to set up valid lines of argumentation;

To improve your communication skills;

To improve your skills in working effectively in a project team, through team building, team analysis and feedback.

Inhoud vak

In this course you get the chance to gain experience in the practical implementation of methodologies for interactive research. In a four week policy project you will both improve your focus group research skills and deepen your understanding of the relevant theoretical concepts in the areas of policy studies, science and technology studies and

democracy theory. In a group of about ten students you will participate in a real interactive research project which is executed at the Athena institute. In this project you will be trained in and practice various skills for data collection (such as focus group design and facilitation) and data analysis (such as qualitative content analysis).

Specific attention is paid to your personal interactive research skills.

At the end of the course, you

prepare a policy report to present your findings. In an oral presentation your team will highlight the main results of your analysis and defend the recommendations you propose.

Onderwijsvorm

Lectures, training workshops, project assignment

Toetsvorm

Individual evaluation based on personal performance in the project group and assessment of various group products (report and presentation). All parts need to be passed.

Literatuur

To be announced on Blackboard

Doelgroep

Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life sciences (MPA), Societal differentiation of the Health, Life & Natural Sciences.

Overige informatie

Basic knowledge of (interactive) policy processes, policy analysis and relevant research skills are required.

Attendance is compulsory.

Praktijk I

Vakcode	O_MLPRAKI ()
Periode	Semester 1, Semester 2
Credits	15.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Niveau	500

Doel vak

De student maakt kennis met het onderwijs in de praktijk, verzorgt lessen en is betrokken bij andere leerlinggerichte activiteiten. Hij kan binnen de context van de school theoretische inzichten praktisch vormgeven en weet de praktijkomgeving te benutten om aan eigen ontwikkelpunten te werken.

De student werkt samen met anderen binnen en buiten de school en kan zijn functioneren als teamlid beschrijven en toelichten.

Inhoud vak

Het totale aantal klassencontacturen dat een student moet maken tijdens Praktijk 1 en 2, bedraagt tenminste 250. Tijdens deze uren observeert of verzorgt de student lessen en neemt deel aan andere leerlinggerichte activiteiten. Hij/zij geeft tenminste 120 lessen, waarvan minimaal 40 lesuren in de bovenbouw havo/vwo.

De verdeling en fasering van dit aantal uren over Praktijk 1 en 2 wordt in overleg met de begeleider op school bepaald. In Praktijk 1 ligt de nadruk op het observeren en het onder begeleiding voorbereiden, uitvoeren en evalueren van lessen.

Dit opleidingsonderdeel loopt parallel aan vakdidactiek 1 en algemene didactiek en pedagogiek 1, waardoor een goede wisselwerking mogelijk is tussen theorie en praktijk.

Toetsvorm

Praktijk 1 wordt door de schoolbegeleider beoordeeld aan de hand van een checklist. De schoolbegeleider doet daarbij een voorstel dat door de instituutsbegeleider moet worden onderschreven.

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding

Praktijk II

Vakcode	O_MLPRAKII ()
Periode	Semester 1, Semester 2
Credits	15.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Niveau	500

Doel vak

De student kan, als docent-in-opleiding, verantwoordelijkheid dragen voor het zelfstandig voorbereiden, uitvoeren en evalueren van lessen in de onder- en bovenbouw van het Havo/VWO. Hij kan tevens een bijdrage leveren aan schoolbrede activiteiten. Hij kan binnen de context van de school theoretische inzichten praktisch vormgeven en weet de praktijkomgeving te benutten om aan eigen ontwikkelpunten te werken. Hij kan reflecteren op opgedane ervaringen en verworven inzichten en deze op dusdanige manier beschrijven dat zij inzichtelijk worden voor anderen. De student toont zich professioneel in de samenwerking met anderen binnen en buiten de school en kan zijn functioneren als teamlid beschrijven en toelichten.

Inhoud vak

Het totale aantal klassencontacturen dat een student moet maken tijdens Praktijk 1 en 2, bedraagt tenminste 250. Tijdens deze uren observeert of verzorgt de student lessen en neemt deel aan andere leerlinggerichte activiteiten. Hij/zij geeft tenminste 120 lessen, waarvan minimaal 40 lessen in de bovenbouw havo/vwo.

De verdeling en fasering van dit aantal uren over Praktijk 1 en 2 wordt in overleg met de begeleider op school bepaald. Tijdens Praktijk 2 draagt de student verantwoordelijkheid voor een of meer klassen. Hij bereidt het onderwijs voor, voert het uit en evalueert het. Hij werkt hierbij nadrukkelijk samen met sectiegenoten en andere collega's binnen de school en is zich bewust van de context waarin zijn lessen plaatsvinden. In het portfolio doet hij verslag van zijn functioneren

als teamlid en collega in de school.

Dit opleidingsonderdeel loopt parallel aan vakdidactiek 2 en algemene didactiek en pedagogiek 2, waardoor een goede wisselwerking mogelijk is tussen theorie en praktijk.

Toetsvorm

Praktijk 2 wordt door de schoolbegeleider beoordeeld aan de hand van een checklist waarop het eindcijfer voor de praktijk wordt gebaseerd. De schoolbegeleider doet daarbij een voorstel dat door de instituutsbegeleider moet worden onderschreven.

Tevens beoordeelt schoolbegeleider het functioneren van de student als teamlid en collega op basis van de door de student uitgevoerde portfolio-opdrachten.

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding.

Probabilistic and Extremal Combinatorics

Vakcode	X_418118 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

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

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

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

Doelgroep

mMath

Professionele ontwikkeling en onderzoek I

Vakcode	O_MLVPOOI ()
Periode	Semester 1, Semester 2
Credits	3.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	ir. E.J.F. Scheringa
Docent(en)	drs. Y.G. Meindersma, dr. H.B. Westbroek, drs. H.R. Goudsmit, drs. I. Pauw, drs. S. Attema-Noordewier

Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

De student kan systematische reflecteren op het eigen handelen in de onderwijspraktijk en daardoor richting geven aan de eigen professionele ontwikkeling.

De student kan een onderzoeksvraag formuleren voor een onderzoek aan zijn/haar eigen onderwijspraktijk, deze vraag inbedden in een theoretisch kader en een opzet maken voor de uitvoering van het onderzoek.

Inhoud vak

Dit vak bestaat uit twee delen: een reflectiedeel en een onderzoeksdeel.

Het reflectiedeel krijgt vorm en inhoud in zogenaamde peergroepbijeenkomsten. Hierin reflecteert de studenten samen met anderen op zijn/haar handelen in de praktijk en leert daaruit ontwikkelpunten af te leiden, acties te formuleren en deze te evalueren. Verschillende instrumenten en methodes worden gebruikt (logboek, reflectiecirkel, intervisie,...) om de student in staat te stellen de complexiteit van de onderwijspraktijk te doorgronden en hiervan te leren.

In het onderzoeksdeel wordt een opzet gemaakt van een praktijkonderzoek. In dit onderzoek diept de student één of meer vraagstukken uit de (eigen) onderwijspraktijk uit, waarbij een onderzoeksvraag ingebed wordt in een theoretisch kader en op één of enkele scholen empirisch materiaal wordt verzameld. In plenaire bijeenkomsten komen onderwerpen aan de orde als het formuleren van de probleemstelling en de onderzoeksvraag, het verkennen van de literatuur en het verzamelen van de data. Daarnaast kan de student beroep doen op individuele begeleiding rondom zijn/haar onderzoek. Dit alles mondt uit in een eerste onderzoeksformat voor het praktijkonderzoek dat vervolgens in het vak Professionele Ontwikkeling en Onderzoek 2 uitgevoerd, gepresenteerd en geëvalueerd wordt.

Onderwijsvorm

colleges, werkgroepbijeenkomsten en individuele begeleiding van het onderzoek door instituutsbegeleiders.

Toetsvorm

Uitvoeren van opdrachten.

Literatuur

Een literatuurlijst wordt verstrekt aan het begin van de opleiding.

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding.

Overige informatie

Voor alle onderdelen geldt een aanwezigheidsplicht.

Professionele ontwikkeling en onderzoek II

Vakcode	O_MLVPOOII ()
Periode	Semester 1, Semester 2
Credits	6.0

Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	dr. H.B. Westbroek
Docent(en)	dr. C.P. van Velzen, prof. dr. J.J. Beishuizen, drs. W. Jongejan, dr. H.B. Westbroek, dr. E. van den Berg, dr. J.J.M. van Eersel, W. Maas, drs. Y.G. Meindersma, drs. S. Attema-Noordewier, dr. T. Bosma, dr. A.A. Kaal
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

De student kan een praktijkonderzoek opzetten, uitvoeren en hierover rapporteren.

Inhoud vak

In het praktijkonderzoek diept de student één of meer vraagstukken uit de (eigen) onderwijspraktijk uit. Hij of zij doet dat door het opzetten, uitvoeren en evalueren van een op de eigen onderwijspraktijk gericht onderzoek waarbij op één of enkele scholen empirisch materiaal wordt verzameld. Aan de hand van de opzet die gemaakt is tijdens de module Professionele Ontwikkeling en Onderzoek 1 ontwerpt de student onderzoeksinstrumenten om empirisch gegevens te verzamelen voor het beantwoorden van de onderzoeksvraag en voert hij/zij het onderzoek uit. In een artikel voor een vaktijdschrift voor leraren rapporteert hij/zij over het onderzoek waarin aan de orde komen vraagstelling, relevantie, verankering in bestaande theorie, gebruikte instrumenten, data, conclusie en discussie. De student presenteert ook zijn/haar onderzoek tijdens de Onderwijsresearchdag.

Onderwijsvorm

Onderzoek, verplichte deelname aan colleges praktijkonderzoek, werkgroepbijeenkomsten, individuele begeleiding door instituutsbegeleiders.

Toetsvorm

De rapportage van het praktijkonderzoek vindt plaats in de vorm van een posterpresentatie en een artikel voor een vaktijdschrift voor leraren.

Het artikel wordt gezamenlijk beoordeeld door de eerste begeleider en tweede lezer, die wordt aangezocht door de eerste begeleider. De presentatie van het onderzoek op de Onderwijsresearchdag wordt meegenomen in de eindbeoordeling. Ook de mate van zelfstandigheid in het opzetten, uitvoeren en rapporteren van het onderzoek wordt beoordeeld

Literatuur

Een literatuurlijst wordt verstrekt aan het begin van de opleiding.

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding.

Om dit vak te volgen moet het vak Professionele Ontwikkeling en Onderzoek 1 met goed gevolg zijn afgelegd.

Overige informatie

Voor alle onderdelen geldt een aanwezigheidsplicht.

Qualitative and Quantitative Research Methods

Vakcode	AM_470582 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. J.F.H. Kupper
Docent(en)	dr. H. Wels, dr. B.J. Regeer, dr. J.F.H. Kupper, dr. ir. R. Hoopman
Lesmethode(n)	Hoorcollege, Werkgroep, Computerpracticum
Niveau	400

Doel vak

Understanding the differences between beta- and gamma research
To acquire insight and understanding of a transdisciplinary research process. This includes knowledge of the character of and need for transdisciplinary approaches, and their advantages and disadvantages
To acquire insight into various quantitative and qualitative research methods and their underlying theoretical concepts
To understand the relative strengths and weaknesses of the various research methods
To know how to interpret quantitative and qualitative findings
To acquire insight and understanding of the possibilities to integrate quantitative and qualitative research information
To be able to make an adequate transdisciplinary research design for the investigation of a specific problem.

Inhoud vak

Contemporary societies increasingly face complex social problems, like climate change, HIV/ AIDS or ethnic and religious diversity . These complex problems involve a variety of social actors: policy-makers, professionals, NGOs, industry, science and of course the public at large. Addressing such complex issues demands a transdisciplinary approach that investigates, analyzes and integrates the positions and knowledge of different actors. This course offers an (advanced) introduction to various research methods used in transdisciplinary research: questionnaires, systematic observations using all the senses, surveys and statistics, semi-structured in-depth interviews, as well as several interactive and participatory methods. These methods are commonly used in transdisciplinary research into complex problem contexts, communication, and opportunities for intervention. Strengths and weaknesses of each research method and technique will be discussed, as well as its possibility to be applied in different societal contexts. Throughout the course, you will apply theoretical knowledge about the various research methodologies in the training of different qualitative and quantitative methods, and in making a research design. In small groups, students are trained in: (1) qualitative research methods such as semi structured interviews and observation techniques, (2) quantitative research methods such as questionnaires, 3) analysis of the data, and (4) writing a transdisciplinary research design.

Onderwijsvorm

Lecture (20h), Training workshops (30h), Self-study (107h), Examination (3h).

Toetsvorm

Group assignment (50%) and exam (50%). Both parts need to be passed (6).

Literatuur

Announced on blackboard one month before course starts

Doelgroep

Compulsory course in the Master programme Management, Policy Analysis and Entrepreneurship for the Health and Life Sciences (MPA) and compulsory course within the Science communication- and Societal differentiations of Health, Life and Natural Sciences Masters programmes.

Overige informatie

Attendance of training workshops is compulsory. For further information please contact harry.wels@falw.vu.nl.

Quantum Groups and Knot Theory

Vakcode	X_400343 (400343)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/8090.html>

Overige informatie

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

Queueing Theory

Vakcode	X_400397 (400397)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Rational Points on Varieties

Vakcode	X_418119 ()
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	600

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

Riemann Surfaces

Vakcode	X_400325 (400325)
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

Overige informatie

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>.

Scheduling

Vakcode	X_400396 (400396)
Periode	Periode 4+5

Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Science and Communication

Vakcode	AM_470587 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. B.J. Regeer
Docent(en)	dr. B.J. Regeer, dr. J.F.H. Kupper, T. de Lange MSc, B.M. Tielemans
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

- Gain theoretical insight in the relationship between science and society,
- Gain insight in the role of science communication in this relationship,
- Acquire knowledge of different theories and models of science communication,
- Acquire knowledge of different strategies, media and activities for science communication,
- Learn how to apply theoretical concepts to real-life examples,
- Development of practical skills for science communication (e.g. writing, discussing).

Inhoud vak

Science is all around us and shapes our lives in many different ways. From the vaccines you need for travelling abroad, to the technological devices you use on a daily basis. At the same time, society shapes the development of science and technology. Science and society influence each other continuously; they communicate. Students of Science Communication are expected to become experts in understanding and designing interaction between science and society. In order for this interaction to be fruitful and valuable for both science and society, it is important to gain in-depth knowledge about the theoretical basis of the field of science communication and understand communication processes at the core of several interfaces; e.g. the communication

between scientists from different disciplines, between different sciences and their stakeholders, and between science and the public. This course provides a broad basis in the field of science communication by addressing the main areas of science communication and by discussing and challenging several core concepts within this field. Students are invited to explore some issues in greater depth and active participation in lectures and workgroups is required.

Onderwijsvorm

Lectures (22 h)
 Workgroups (18 h)
 Home-study for group assignments (8 h)
 Home-study for individual assignments/exam (90h)

Toetsvorm

Individual assignments (30%), group assignment (10%), examination (60%).
 For all parts a pass grade needs to be obtained.

Literatuur

Academic articles. Direct links to articles will be provided on BlackBoard one month before the beginning of the course.

Doelgroep

The course Science and Communication is a compulsory course for students of the Master specialisation Science Communication (Wetenschapscommunicatie) and is a prerequisite for the internship. Science and Communication is an optional course for students from other master programs in the health and life sciences.

Overige informatie

Guest lecturers amongst others:
 A. van der Plas (TNO)
 F. van Dam (CSG, Centre for Society and the Life Sciences)

Science in Dialogue

Vakcode	AM_1002 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. J.F.H. Kupper
Docent(en)	dr. J.F.H. Kupper
Lesmethode(n)	Werkgroep, Hoorcollege
Niveau	500

Doel vak

To gain knowledge and insight into:

- the basic concepts and issues in the understanding of science-society interactions, both from a philosophical and communication science perspective
- the nature and course of interpersonal and group communication processes relevant to the formal and informal dialogue between science and society
- the nature and form of dialogical science communication, aimed at

mutual understanding and learning

To acquire or improve:

- the individual student's skills for effective interpersonal communication
- the individual student's skills for the design and facilitation of the science-society dialogue

Inhoud vak

This course examines the public character of scientific controversy and focuses on the communicative aspects of a fruitful science-society dialogue. At the dawn of the 21st century, science, and particularly fields that combine science and engineering such as nanotechnology and synthetic biology, holds a great promise for the progress of our societies. At the same time, these developments are controversial. They lead to a variety of concerns related to risks, benefits and wider moral issues. Nanotechnology creates materials with novel characteristics that help us, but may also contain risks for health and environment. Synthetic biology develops new biological systems that may be very useful, but radically change the nature and meaning of life. Clearly, advances in science do not always match the needs, desires and expectations of society. On the other hand, parts of society might not always appreciate the nature and scope of scientific findings. For a fruitful relationship between science and society, a constructive science-society dialogue is necessary.

This course offers advanced lectures on the basic concepts and issues of dialogical science communication: communication, learning, dialogue, understanding, controversy, democracy. A series of workshops and small group assignments presents communicative tools and spaces such as discussion games, science theatre and multimedia platforms that can be used to design and facilitate science-society interactions. Training workshops will focus on improving the students' individual communication and facilitation skills. The students' individual learning curve as a science communicator and facilitator is monitored by means of a personal development plan. The course is completed with an individual essay assignment about the sense and nonsense of the science-society dialogue.

Onderwijsvorm

Lectures (14h), Workgroups (28h), Training workshops (24h), Selfstudy, (82h), Dialogue presentations (12h)

Toetsvorm

Group assignment (50%), Take home exam (30%), Mini portfolio (20%)

Literatuur

Is announced on blackboard one month before start of the course

Doelgroep

Optional course in the MSc specialization Science Communication

Overige informatie

Independence and a cooperative attitude is expected. Attendance to training workshops is indispensable.

Science Journalism

Vakcode	AM_471014 ()
Periode	Periode 2

Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. J.F.H. Kupper
Docent(en)	dr. J.F.H. Kupper, W.J. Breukers MSc, dr. M.J.W. Bos
Lesmethode(n)	Hoorcollege, Werkgroep, Computerpracticum
Niveau	500

Doel vak

To acquire knowledge and insight into:

- the popularization of natural scientific knowledge and the use of different media
- the criteria for effective science journalism with respect to diverse media
- the role of science journalists in the debate about knowledge in society

To acquire skills in:

- writing popular scientific texts for different genres such as news, background and interview
- designing science communication for different media such as newspaper, radio and internet

Orientation to the professional practice of science journalism

Inhoud vak

This course teaches the basic principles of science journalism. A series of interactive lectures reviews both the practical as well as the theoretical aspects of science journalism. Topics that are discussed are the translation of science to a language that is both compelling and understandable, the role of journalism in the interaction between science and society, images of science in the media and the ethics of science journalism. The interactive lectures invite you to take your own defensible position with regard to these issues.

Guest lectures provide insight into the professional practice of science journalists. The guest speakers work as freelancer, editor or producer at diverse science media, such as newspapers (NRC, Volkskrant), magazines (NWT), internet (Noorderlicht) and radio (Labyrint).

Finally, the course trains specific skills that you need as a science journalist, such as popular writing, interviewing, conceptual analysis and program design.

Onderwijsvorm

Lectures and seminars on theory and practice of science journalism and writing skill training (36h). Considerable time is set aside for performing science journalism in assignments (108h). The assignments are assessed by lecturers and fellow students (peer-review process). Self study (16h).

Toetsvorm

Individual exam (20%), Individual Assignments (50%, Small Group Assignments (30%)

Literatuur

Announced on Blackboard one month before start of the course

Doelgroep

All Master students with a Beta-Bachelor degree. Students taking this course as part of their C-differentiation within FALW or FEW will have precedence over other students. Students from other faculties and or universities need to get formal consent from the course co-ordinator (Frank Kupper) before enrolment.

Overige informatie

Course is taught in Dutch. More information: f.kupper@vu.nl.

Science Museology

Vakcode	AM_470590 ()
Periode	Periode 3
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. B.J. Regeer
Docent(en)	dr. B.J. Regeer, drs. ir. M.G. van der Meij, T. de Lange MSc
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak

- Gain insight in the role of museum exhibits in the field of science communication.
- Apply theoretical notions of science communication and science education, to conduct science communication research in museum settings.
- Apply qualitative and quantitative research methods to design, conduct, and report on a research project in museum settings.
- Apply theoretical notions of science communication, science education and exhibit design to advise on adjustments and/or development of exhibitions.

Inhoud vak

This course is about the role of science museums/centers, zoos and natural history museums in science communication. You will get familiar with theories of science communication and informal science education in museum setting, and will be introduced to different educational methods as well as styles of communication, different approaches to exhibit design & development, and different methods of research and evaluation of exhibitions.

Guest speakers give insight into their profession (1) as science communicators in museums and science centers, (2) as researchers in the field of museology, and/or (3) as professionals in developing informal science & technology learning programs.

Through several assignments you are encouraged to combine theory and practice, working step-by-step towards (part of) an exhibition (re-) design. The assignments come from museums and science centers, such as NEMO, Museon, Naturalis, Delft Science Centre, and Artis.

Onderwijsvorm

Lectures (14 h)

Workgroups (40 h)

Home-study for group assignments (64 h)

Home-study for individual assignments (32 h)

Toetsvorm

Group assignment (40%), presentations (poster and oral) (10%), and exams (take-home and written) (50%). For all the assignment, presentations and all exams a pass-grade must be obtained.

Literatuur

Academic articles. Direct links to articles will be provided on Blackboard one month before the beginning of the course.

Vereiste voorkennis

Bachelor in any of the Beta Sciences

Doelgroep

Optional course in the C-differentiations (Science Communication) of most of the two-year master programs of the FALW and FEW faculties. Master students from other universities in any scientific field are welcome as well.

Overige informatie

Guest lecturers:

E. Hamstra (Northernlight)

C. Vermeulen (Artis)

M. van der Meer (Delft Science Centre)

I. van Zeeland (Naturalis)

And possibly additional guest lecturers from NEMO, Boijmans van Beuningen, Museon, Van Gogh Museum, etc.

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
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

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

Inhoud vak

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

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

General course outline

Introducing the topics

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

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

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

Writing the actual article

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

Should I use "I" or "we"?

Writing correct English

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

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

Onderwijsvorm

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

Toetsvorm

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

Literatuur

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

Vereiste voorkennis

Bachelor Exact Sciences

Doelgroep

mBA, mSFM en mMath

Seminar Mathematics

Vakcode	X_405024 (405024)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.W.J. Meester
Docent(en)	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, organise the material for the framework of a seminar talk, and practice presentation skills for such a talk. At the end of the course, the student will be able to acquire the prerequisites for reading and understanding a paper by researching the literature on his own, understand the logic of a paper, and to critically evaluate a paper. he will be able to extract and condense the material for a talk of a fixed length.

Inhoud vak

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

Onderwijsvorm

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

Toetsvorm

Seminar talk

Literatuur

Various; will be announced in the seminar

Doelgroep

mMath

Overige informatie

This course will be given by prof.dr. R.W.J. Meester (VU) and dr.H. Posthuma (UvA), in period 1 the course at the UvA, in period 2 at the VU. Course registration is compulsory. VU students register at the VU and UvA students at the UvA (<https://www.sis.uva.nl>). Note: presence at all meetings is compulsory.

Semiparametric Statistics

Vakcode	X_400605 (400605)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	400

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/en/c/8852.html>

Doelgroep

mMath, mSFM

Overige informatie

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

Simulation Methods in Statistics

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

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/en/c/170.html>

Doelgroep

mMath, mSFM

Overige informatie

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

Statistical Data Analysis

Vakcode	X_401029 (401029)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Bijma
Docent(en)	dr. F. Bijma
Lesmethode(n)	Hoorcollege, Werkcollege
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 real data set. Using the learned statistical tools, the student is able to summarize and analyze real data sets.

Inhoud vak

This is an advanced level statistical data analysis course that builds on an introductory course on statistics, e.g. 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 and written exam.

Literatuur

Lecture notes.

Aanbevolen voorkennis

Students should have basic knowledge on statistics, e.g. Algemene Statistiek (X_400004).

Doelgroep

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

Overige informatie

Language of tuition: English

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
Docent(en)	prof. dr. M.C.M. de Gunst, dr. E.N. Belitser
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The student will be able to accurately apply several common statistical models in valid settings, and will demonstrate understanding of the theoretical foundation for each model.

Inhoud vak

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

Onderwijsvorm

Course of lectures, exercises and tutorial

Toetsvorm

Course of lectures, exercises and tutorial.

Literatuur

"Statistical Models" by Prof. dr. M.C.M. de Gunst

Vereiste voorkennis

Algemene Statistiek (X_400004) and Statistische Data Analysis (X_401029). A sufficient mark for the exercises is required for entry to the written examination.

Aanbevolen voorkennis

Algemene Statistiek (X_400004) and Statistische Data Analysis (X_401029). A sufficient mark for the exercises is required for entry to the written examination.

Doelgroep

mBA, mBA-D, mMath

Statistics for High-Dimensional Data

Vakcode	X_405113 ()
Periode	Periode 4+5
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

Stochastic Differential Equations

Vakcode	X_400454 (400454)
Periode	Periode 4+5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. G.J.B. van den Berg
Niveau	500

Inhoud vak

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

For schedules, course locations and course descriptions see

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

Doelgroep

mMath

Stochastic Integration

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

Inhoud vak

The course description is available on:
<http://studiegids.uva.nl/web/uva/sgs/en/c/173.html>

Doelgroep
mMath, mSFM

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

Stochastic Optimization

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

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

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

Onderwijsvorm
Lectures.

Toetsvorm
Programming and written exercises, final examination.

Literatuur
Lecture notes will be posted on BlackBoard

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

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

Doelgroep

Stochastic Processes

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

Stochastic Processes for Finance

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

Doel vak

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

Inhoud vak

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

A "stochastic process" is a collection of random variables, indexed by a set T . In financial applications the elements of T model time, and T is the set of natural numbers (discrete time), or an interval in the positive real line (continuous time). "Martingales" are processes whose

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

Onderwijsvorm

Lectures and exercises.

Toetsvorm

Homework assignments / written examination.

Literatuur

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

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

In addition, it is useful to have the following book:

Bjork, T., Arbitrage Theory in Continuous Time, third edition. Oxford University Press.

Vereiste voorkennis

Introductory probability theory and statistics, calculus.

Aanbevolen voorkennis

Introductory probability theory and statistics, calculus.

Doelgroep

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

Overige informatie

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

Systems and Control

Vakcode	X_400332 (400332)
Periode	Periode 1+2
Credits	6.0

Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	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

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
Niveau	600

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/12294.html>

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. G.J.B. van den Berg
Docent(en)	prof. dr. A.W. van der Vaart
Lesmethode(n)	Hoorcollege
Niveau	500

Inhoud vak

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

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

Doelgroep

mMath

Topics in stochastic networks

Vakcode	X_418089 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak

The course description is available on:

<http://studiegids.uva.nl/web/uva/sgs/nl/c/14272.html>

Doelgroep

mSFM, mMath

Overige informatie

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

Topological Methods for Nonlinear Differential Equations

Vakcode	X_400382 ()
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. R.C.A.M. van der Vorst
Docent(en)	prof. dr. R.C.A.M. van der Vorst
Lesmethode(n)	Hoorcollege
Niveau	600

Doel vak

Basic topological tools for studying and understanding nonlinear partial differential equations and dynamical systems.

Inhoud vak

In this course a variety of topological techniques are discussed that are important in the modern treatment of partial differential equations and dynamical systems. Among these are degree theory (finite and infinite dimensional), nonlinear Fredholm maps, variational techniques, Morse theory, Floer homology and Conley index. In this course the techniques are explained and motivated via applications to numerous examples in nonlinear differential equations.

Onderwijsvorm

Lectures and assignments

Toetsvorm

Via assignments and oral examination

Literatuur

Course notes

Aanbevolen voorkennis

A course on partial differential equations

Doelgroep

mMath

Topologie 1

Vakcode	X_400416 (400416)
Periode	Periode 1+2
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. D.R.A.W. Notbohm
Docent(en)	dr. D.R.A.W. Notbohm
Lesmethode(n)	Hoorcollege, Werkcollege, Deeltoets extra zaalcapaciteit
Niveau	300

Doel vak

De studenten bekend maken met de eerste beginselen van de Algemene Topologie

Inhoud vak

Aan de orde komen:

- topologie van metrische ruimten, volledigheid, stelling van Baire;
- algemene topologische ruimten, bases en subbases, continue afbeeldingen, homeomorfismen, deelruimten;
- samenhang, wegsamenhang, lokale samenhang;
- compactheid, lokale compactheid, de Cantor verzameling;
- kardinaalgetallen, keuze-axioma, Lemma van Zorn;
- producten, stellingen van Alexander en Tychonoff, quotiënten;
- scheidingsaxioma's, lemma van Urysohn, stelling van Tietze;
- metriseringsstelling van Urysohn.

Onderwijsvorm

Hoorcollege en werkcolleges.

Toetsvorm

Huiswerk en een afsluitend mondeling

Literatuur

ed H. Croom, Principles of Topology, Cengage Learning.

Doelgroep

2W, 3WN

Toric Topology

Vakcode	X_405077 ()
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Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. D.R.A.W. Notbohm
Docent(en)	dr. D.R.A.W. Notbohm
Lesmethode(n)	Hoorcollege
Niveau	600

Doel vak

Students should become familiar with basic concept of a recent research field.

Inhoud vak

Toric Topology is a new subject which appeared at the beginning of the 90's at the horizon of Mathematics. The main topic of this subject is the study of 'nice' spaces, mainly 'nice' manifolds, with 'nice' actions of tori which are finite products of 1-dimensional spheres considered as abelian groups. Examples are given by the $(2n-1)$ -dimensional sphere and the n -dimensional complex projective space, both with an action of a n -dimensional torus. Other examples are provided by Symplectic Geometry (moment angle complexes) and Algebraic Geometry (toric varieties), but I will not say much about the connections with these two subjects.

Toric Topology focuses on topological aspects and studies the objects from a topological point of view. There are also quite a lot of connections with Combinatorics (simplicial complexes) and Algebra, which come into the play.

In this course I will give an introduction into the subject Toric Topology and discuss the foundational paper: M Davis and T Januszkiewicz, convex polytopes, Coxeter orbifolds and torus actions. Duke Math. J. vol 62, 1991. pages 417-451.

I keep the prerequisites as low as possible. I will only assume familiarity with basic concepts in Algebra and Algebraic Topology as discussed in Algebra 2 (groups and rings) and in standard class in Algebraic Topology (homology and cohomology groups of spaces, cup-product in cohomology). Other necessary concepts from Algebraic Topology, Algebra and Combinatorics I will explain and discuss in class.

Onderwijsvorm

Lectures and problem classes

Toetsvorm

Oral exam(75%) and weekly homework (25%)

Literatuur

V. M. Buchstaber and T.E. Panov, Torus Actions and their Applications in Topology and Combinatorics, University Lecture Series 24, AMS (2002) (for a first impression).

M Davis and T Januszkiewicz, convex polytopes, Coxeter orbifolds and torus actions. Duke Math. J. vol 62, 1991. pages 417-451.

Further literature will be announced.

Aanbevolen voorkennis

Algebraic Topology

Doelgroep

mMath

Vakdidactiek Wiskunde I

Vakcode	O_MLVDWII ()
Periode	Semester 1, Semester 2
Credits	3.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	drs. W.S. Hoekstra
Docent(en)	drs. W.S. Hoekstra
Lesmethode(n)	Werkcollege
Niveau	500

Doel vak

De student kan vakinhoudelijke en vakdidactische kennis, vaardigheden en inzichten vertalen naar de eigen vaklessen.

Inhoud vak

Tijdens de vakdidactiekcolleges maakt de student kennis met de inhoud en didactiek van het schoolvak en leert deze inzichten in de praktijk vorm te geven. Er is aandacht voor vakspecifieke kennis en vaardigheden en de voor het schoolvak relevante ICT-toepassingen. In het vakdidactiekprogramma vindt eveneens een vertaling plaats van algemeen didactische thema's naar het vak. De leservaringen op school spelen hierbij een belangrijke rol.

Onderwijsvorm

Werkcolleges

Toetsvorm

Beoordeling van het portfolio

Literatuur

Een literatuurlijst wordt verstrekt aan het begin van de opleiding

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding

Overige informatie

Er geldt een aanwezigheidsplicht

Vakdidactiek Wiskunde II

Vakcode	O_MLVDWIII ()
Periode	Periode 1+2+3, Periode 4+5+6
Credits	6.0

Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	drs. W.S. Hoekstra
Docent(en)	drs. W.S. Hoekstra
Lesmethode(n)	Werkcollege
Niveau	500

Doel vak

De student kan vakinhoudelijke en vakdidactische kennis, vaardigheden en inzichten vertalen naar de eigen vaklessen en zijn aanpak verantwoorden.

Inhoud vak

De tijdens Vakdidactiek 1 opgedane kennis en vaardigheden worden in Vakdidactiek 2 verder uitgebreid en verdiept. In dit semester ligt het accent op het zelfstandig vormgeven van een samenhangende lessenserie gericht op de bovenbouw van het Voortgezet Onderwijs, die inhoudelijk en vakdidactisch verantwoord moet worden.

Onderwijsvorm

Werkcolleges

Toetsvorm

Beoordeling van het portfolio

Literatuur

Een literatuurlijst wordt verstrekt aan het begin van de opleiding

Vereiste voorkennis

Dit vak is alleen te volgen als onderdeel van de universitaire lerarenopleiding

Reguliere studenten dienen eerst Vakdidactiek 1 afgerond te hebben alvorens aan Vakdidactiek 2 kan worden deelgenomen. Voor instromers (studenten met een tweedegraads bevoegdheid en een master in het Schoolvak) geldt deze verplichting niet.

Overige informatie

Er geldt een aanwezigheidsplicht

Variational Methods

Vakcode	X_400598 (400598)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Hulshof
Docent(en)	prof. dr. J. Hulshof
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

Verdieping

Vakcode	O_MLVERD ()
Periode	Semester 1, Semester 2
Credits	3.0
Voertaal	Nederlands
Faculteit	Faculteit der Psychologie en Pedagogiek
Coördinator	dr. J.J.M. van Eersel
Docent(en)	drs. H.R. Goudsmit, dr. J.J.M. van Eersel
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

De student verdiept zich op een onderdeel binnen zijn schoolvak of cluster.

De student is zich bewust van zijn rol als docent in een multiculturele samenleving.

De student kan de verschillende aspecten van diversiteit en multiculturaliteit in het onderwijs benoemen en aangeven hoeverre deze aspecten in zijn of haar eigen schoolpraktijk een rol spelen.

Inhoud vak

Binnen de clusters en vakken worden (verplichte) verdiepingsmodulen aangeboden. Daarnaast volgt elke student het onderdeel multiculturaliteit, waarin een aantal aspecten van onderwijs voor een multiculturele samenleving aan de orde komen:

1. Wat betekent identiteitontwikkeling in het kader van een multiculturele samenleving?
2. Wat is de zin en onzin van intercultureel onderwijs?
3. Wat zijn de verschillende thematieken van diversiteit en multiculturaliteit in de klas?
4. Wat is er bekend uit onderzoek over diversiteit, cultuur, etniciteit in de onderwijspraktijk?

Onderwijsvorm

Hoorcollege, werkcollege.

Toetsvorm

Bespreking van een casus.

Literatuur

Syllabus met artikelen wordt verstrekt.

Wiskundige analyse 2

Vakcode	X_400088 (400088)
Periode	Periode 4+5
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. F. Pasquotto
Docent(en)	dr. F. Pasquotto
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	300

Doel vak

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

Inhoud vak

Dit college behandelt een aantal elementen uit de klassieke analyse. Er wordt voortgebouwd op de stof van het calculus-college, maar met meer aandacht voor de bewijsvoering.

De volgende onderwerpen komen aan de orde:

- afgeleide van vector-waardige functies en de kettingregel;
- inverse functiestelling, impliciete functiestelling;
- definities van deelvariëteiten en raakruimten;
- substitutiestelling voor integralen;
- integratie over deelvariëteiten;
- de stellingen uit Vectorcalculus (Stokes, Gauss, ...)

Onderwijsvorm

Hoorcollege (2 uur per week) met werkcollege (2 uur per week).

Toetsvorm

twee schriftelijke deeltentamens (40% + 40%) en wekelijkse voordrachten door de studenten (20%)

Literatuur

n.n.b.

Vereiste voorkennis

Wiskundige analyse I (X_400087), Lineaire algebra (X_400042)
 Differentiëren en integreren 1, 2 en 3. (X_400573, X_400574, X_400577)

Aanbevolen voorkennis

Wiskundige analyse I, Lineaire algebra
 Differentiëren en integreren 1, 2 en 3.

Doelgroep

2W, 2WN

Workshop Mathematical Modelling

Vakcode	X_401062 (401062)
Periode	Periode 3
Credits	6.0
Voertaal	Nederlands

Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. Hulshof
Docent(en)	prof. dr. R.W.J. Meester, prof. dr. J. Hulshof
Lesmethode(n)	Hoorcollege
Niveau	400

Inhoud vak

Dit vak is een intensieve workshop van vier weken, waarbij de studenten in groepen van 5 à 6 zelf een probleem uit een ander wetenschapsgebied of uit de industrie verkennen, wiskundig modelleren en analyseren. De probleemstellingen zijn open geformuleerd er is geen a priori sturing richting bepaalde deelgebieden van de wiskunde. In de vierde week wordt het werk afgerond met een presentatie en een verslag.

Onderwijsvorm

Project

Toetsvorm

Beoordeling van werkwijze, presentatie en verslag.

Doelgroep

3W, 3-WN, mMath, mPhys