Master Guide Mathematics

2011-2012

Universiteit Leiden
Faculteit der Wiskunde
en Natuurwetenschappen

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Introduction

This guide contains information about the master programme in mathematics and the different specialisations, a description of the master courses that are offered and a class schedule. In addition to the courses offered by the Maths department itself, it lists the master courses in the Dutch Master Programme in Mathematics (www.mastermath.nl), a joint effort of all Dutch departments of mathematics. These courses can be part of a master programme in mathematics at any of the participating institutions.

This guide can be profitably consulted by all students that follow one or more of the courses it lists: regular master students, advanced bachelor students, students from other Dutch universities, international students enrolled in the ALGANT programme, and visiting foreign exchange students. In case the specific information needed for your individual study programme is not given in full detail, do not hesitate to contact one or more of the faculty members listed on the next page for help.

Information in this paper version of the guide is believed to be accurate at the time of printing. Updates and changes can be found in the electronic version of the guide at

http://studiegids.leidenuniv.nl/.

Leiden, July 1, 2011

Prof. dr. Bas Edixhoven
Director of Education (until September 1, 2011).

General information

The Mathematical Institute is located in the
Snellius building, Niels Bohrweg 1, Leiden
PO Box 9512, 2300 RA Leiden

Director of Education:
Prof. dr. S.J. Edixhoven (until September 1, 2011)
phone: (071) 527 7136
e-mail: edix@math.leidenuniv.nl

Dr. B. de Smit (from September 1, 2011)
Phone: (071) 527 7144
e-mail: desmit@math.leidenuniv.nl

Student advisor:
Dr. M. Lübke
phone: (071) 527 7110
e-mail: studieadviseur@math.leidenuniv.nl

Graduate School Office:
Ms. B. ten Hove
Gorlaeus Lab. room HB2.06 ("Educatief Centrum")
phone: (071) 527 4282
e-mail: Hove@edufwn.leidenuniv.nl

Chairman of the Department Teaching Committee ("Opleidingscommissie")**:**
Dr. M.F.E. de Jeu
phone: (071) 527 7118
e-mail: mdejeu@math.leidenuniv.nl

Chairman of the Board of Examiners ("Examencommissie")**:**
Prof. dr. R.D. Gill
phone: (071) 527 7137
e-mail: gill@math.leidenuniv.nl

Chairman of the Board of Admissions ("Toelatingscommissie")**:**
Dr. M. Lübke
phone: (071) 527 7110
e-mail: lubke@math.leidenuniv.nl

Organisational matters

Rules and Regulations

In the Student Charter ('Studentenstatuut' in Dutch) all rights and obligations of students, the University, Faculty and programme are laid down. Besides being a collection of all rights and obligations, the Student Charter also lists all facilities provided by the University available to students. The charter also contains an overview of the legal protection of students.
The rights and obligations laid down in the Student Charter are derived from the legislation of the Higer Education and Reseach Act ('Wet op het Hoger Onderwijs en Wetenschappelijk Onderzoek –WHW).
Every student is assumed to have taken notice of all parts of the Student Charter.

The charter comprises two parts. The Institutional part is equal for all students and can be found on the website of the University www.regulations.leiden.edu/education-students/student-charter.html and a hard copy is made available at PITSstop (Information and Support Services & Information Desk Plexus Student Centre).
The departmental part of the charter addresses students of a specific programme and comprises two parts: the Course and Examination Regulations (OER in Dutch) and the Rules and Regulations for the examinations, practicals and final examinations (R&R). In the OER en R&R a.o. the rules of the Faculty regarding admission, examinations, the degree programme and organisation are laid down.
The texts of these documents can be found on the website of the faculty www.science.leidenuniv.nl >> Graduate School >> MSc Regulations

uSis and ULCN account

Upon registration at the University every students receives a student number and accompanying ULCN account. The ULCN account provides access to the following facilities.

- Work stations
  Access to work stations (PCs) in the faculties, in Plexus student centre and the University Library.
- Leiden University Wireless Access (LUWA)
  LUWA provides wireless access to internet with your own laptop.
- uMail
  Access to your uMailbox, including mail forwarding to an alternative mail address.
- uSis (Student Information System)
  Registering and deregistering for exams, work groups and courses, applying for exam results and notifying change of address.
- uPrefs
  Here you can change your ULCN password and create extra settings for Blackboard
- Blackboard
  Access to the digital teaching environment

- UB Catalogue
  Searching for books and journals (including electronic journals) in the libraries of University Leiden Libraries.
- Digital Library
  Access to catalogues, bibliographic files, full-text sources and electronic journals of University Leiden Libraries. You have also free access to the mathematical databases MathSciNet and Zentralblatt. Further, with your ULCN account you freely download chapters of books from the Springer e-book collection.
- eStemmen
  Voting for student members of faculty and university boards
- Surfspot
  Ordering software via a campus licence.
- Weblog
  Maintaining a blog, including an academic blog

When you have problems with your account, please contact your local ICT-helpdesk.

Your ULCN account gives you access to uSis. In uSis all student data as address, programme and grades are registered. Students can monitor their own progress. Registration for courses, examinations, minors etc. should be done via uSis.
More information on the system, manuals and FAQs can be found on:
http://students.leiden.edu/student-life/student-facilities/

Registration for courses, examinations, tutorials, practicals

According to general regulations of the Faculty of Science, students who wish to participate in any of the educational programmes of the Faculty of Science need to register themselves via uSis. Without timely registration, participation may not be possible and potentially a grade cannot be registered.

Registration for courses opens six weeks before the start of the semester and closes a week before the activity commences. Registration for a course includes the examination.
Registration for (a re-sit of) an examination is possible up to one week before the day of (the re-sit of) the examination. If conditions apply to participating in a second examination, they are laid down in the R&R. An oral examination does not require registration in uSis.

Results of examinations

Grades for examinations, as set by the examiner, will be registered in uSis by the Graduate School Office (‘Educatief Centrum’ in Dutch). Students can check their grades themselves via www.usis.leidenuniv.nl and keep track of their own progress.
Examination cards (tentamenkaart in Dutch) and other forms used for assessment can be used for individual courses, like research projects, thesis or

oral examinations. The assessments should be handed in at the Graduate School Office, where they will be registered. Individual courses should be approved by the Board of Examiners in advance. Requests for approval can be submitted using uSis.

Application for the Master final examination

When a student is convinced to have passed all necessary components of the degree programme, an application for the final examination can be done.

At least five weeks before the desired graduation date, a request should be sent via uSis. All grades of the MSc degree programme have to be registered at that time. Contact the study advisor or study coordinator in due time to make sure all courses are properly registered. Further information on the Master exam is given below.

Petitions in uSis

The initial study requirements shown are based upon defaults for your specific academic program and plan combination. By using ‘petition requests” it is possible to adjust these to your specific situation.

Your requirements may only be changed by the board of examiners (examen commisie). They need a petition request to analyze the situation. The board of examiners can accept or reject a petition request. If the petition request is accepted then your study requirements will be adjusted. You may submit a petition request for the following reasons:

- Request exemption for a particular subject
- Request a deviation in the number of study points required for a subject
- Request an extracurricular course
- Substitution of one course by another course that is offered by Leiden University
- Courses that have been studied in another university may be added via External Education
- Request for a (research) project or thesis.

The Master Exam

At least **5 weeks** before the intended date of the exam, the candidate informs the study advisor for master students about the planned exam, and registers for it at the Graduate School Office (‘Educatief Centrum’) by means of uSis. All grades of the courses and projects completed in the MSc degree programme, as well as the bachelor diploma or any other proof of admission to the master programme, must have been registered at that time.

At the time of registration for the exam, the thesis advisor must have certified that the master thesis meets the requirements for the exam, in particular that it is worth 40 EC. The thesis advisor declares the thesis ready for examination only if

- the thesis is completed,
- a public talk by the student about the thesis has been scheduled before the exam.

If the thesis is to be prepared within the framework of an internship, at the beginning of the project the thesis advisor must make an arrangement with the enterprise or organisation in case the project will hit at confidential information. In particular, it must be guaranteed that the talk, thesis and presentation resulting from the project are suitable for public presentation and demonstrate the mathematical quality of the work.

The thesis advisor asks at least two other faculty members to read the thesis and to become members of the committee for this exam. In any case, a member of the Board of Examiners, preferably the Director of Education, will act as chairman of the committee. If the thesis has been written within the framework of an internship, the external advisor as well is asked to become a member of the committee.
The study advisor checks, in consultation with the Graduate School Office, if all requirements (sufficient credits for the right courses, including the thesis, etc.) are met and discusses the results with the Board of Examiners. If this Board approves the exam, the student agrees with the thesis advisor and the other members of the committee on a date and time and reports this to the student advisor.

The exam takes place in the classroom reserved for it, and is publicly accessible, in particular for friends and relatives of the candidate.
Before the exam takes place, the candidate delivers two hard copies of the thesis to the student advisor and an electronic version (preferably in PDF-format) for publication in the online archive of the MI.
The thesis is written in English unless the Board of Examiners allows another language.
On the title page (see www.math.leidenuniv.nl/~lubke/MScPhD/title.html for an example) are mentioned:
- name of author, title of thesis, name of thesis advisor and date of exam;
- Master thesis, Mathematisch Instituut, Universiteit Leiden.

Protocol of exam:
- The chairman asks the candidate to explain the contents of the thesis in approximately 15 minutes.
- The members of the committee for this exam ask the candidate some questions about the thesis.

- The committee adjourns for deliberation. The thesis advisor proposes a grade for thesis and presentation. The board decides on the definite grade.
- In the classroom, the chairman announces the overall grade with which the exam has been passed.
- The master diploma is handed over by the thesis advisor, after which he makes a short personal speech.

Studying abroad during your Leiden MSc Programme

Students who are enrolled in one of the Leiden University MSc-programmes can choose to spend some time abroad. It is the policy of the University to stimulate this, in order to broaden the students' horizon and improve their academic and language skills. Especially students who are enrolled in a 2-year (research) master programme are advised to spend some time abroad.

Leiden has many bilateral exchange and cooperation agreements with universities all over the world, including many who belong to the top. First of all, Leiden University participates in the European Union's Erasmus programme. This programme offers many possibilities to follow courses or to do a research training project at one of the universities in the European Union, please see:
http://science.leidenuniv.nl/index.php/faculteit/onderwijs/studeren_in_buitenland/contracten

Beside this, there are many exchange agreements with universities outside of Europe such as the United States, Canada, Australia, Japan, South Africa and Korea. Students can also ask their academic staff members to recommend an international institute. A list of the non-European partner universities can be found at www.buitenland.leidenuniv.nl (in Dutch, choose "Uitwisselingsprogramma's buiten Europa").

Conditions:
Students who want to spend some time abroad have to meet certain conditions first: your Board of Examiners has to approve the study program you intend to follow. Furthermore, you must have the right academic qualifications and language skills for the intended programme. You can study abroad one semester or a full academic year. Students of the Faculty of Science should always contact Ms. Gloria Schildwacht for information, registration, selection, introduction to host university, safety regulations, scholarships, etc.

Scholarships and tuition fee:
There are several scholarships for outgoing students, such as the Erasmus scholarship if you stay in Europe and the Lustra scholarship if you go outside of Europe. Students enrolled in a 2-year (research) master programme can apply for the Outbound Study Grant. Selected students who go abroad to an

exchange partner institute don't have to pay tuition fee to the guest university, because they are already enrolled at Leiden University.

Contact and Information:
Ms. Gloria Schildwacht,
International Office of the Faculty of Science
Huygens Lab, Niels Bohrweg 2, room 127
2333 CA Leiden, Phone: 071-527 57 83
Email: schildwacht@edufwn.leidenuniv.nl

Leiden University

ICS Information desk
(enrolment and de-registration, tuition fees, student grants, special enrolment conditions, brochures)
Plexus Student Centre
Kaiserstraat 25, P.O. Box 9500, 2300 RA Leiden
Tel: 071-5278011
Opening hours: Monday, Wednesday, Friday 09.00 – 17.00,
Tuesday and Thursday 09.00 – 21.00
informatiecentrum@ics.leidenuniv.nl / www.leidenunic.nl/ics/sz

PITSstop
(study guides for other universities in the Netherlands, info on studying abroad, the employment market, application procedures and university regulations).
Plexus Student Centre, address: see above
Telephone: 071-5278025
The International Office holds a consultation session at the Meeting Point every Monday and Thursday from 13.00 – 17.00.
PITSstop@Plexus.leidenuniv.nl / www.pitstop.leidenuniv.nl

BUL – Study Options and Careers Advice
(study options and career advice, for € 3.50 a study options test is available; workshops: Career orientation, CV and job application letters, Interviews and the application procedure, Psychological tests and assessment centres)
Plexus Student Centre, address: see above
Telephone: 071-5278011
There is an open consultation session: Tuesday 10.00 – 11.00
bul@ics.leidenuniv.nl / www.bul.leidenuniv.nl .

Student Counsellors
(advice on financial problems, problems with study progress, legal position, students who are involved in top level sports, students with a handicap)
Plexus Student Centre, address: see above
Telephone: 071-527 8026 and 071-527 8011
Open consultation session: Monday to Friday 15.30 – 16.30
decanen@ics.leidenuniv.nl / www.leidenuniv.nl/ics/sz

Student psychologists
(advice on any problem, like family problems, concerns about social contacts, feelings of depression and relationship problems; there are courses and training sessions available)
Plexus Student Centre, address: see above
Telephone: 071-527 8026
Open consultation sessions: Monday to Friday 11.00 – 12.00 Appointments possible: Monday to Friday 09.00 – 17.00
psychologen@ics.leidenuniv.nl / www.leidenuniv.nl/ics/sz

Ombudsperson
(for complaints about the behaviour of a staff member or an administrative body of Leiden University, one can apply to the ombudsperson. He or she is independent and handles complaints in strict confidentiality. Anonymous complaints cannot be dealt with.)
Postal address: P.O. Box 9500, 2300 RA Leiden
Telephone: 071-527 3657 (Monday to Friday 10.00 – 12.30)
Visiting address: Occupational Health Department (GBGD), Poortgebouw Zuid (3rd Floor), Rijnsburgerweg 10, 2333 AA Leiden
Telephone: 071-527 8015
ombudsfunctionaris@leidenuniv.nl
www.ombudsfunctionaris.leidenuniv.nl

(Sexual) Harrassment
(any cases of sexual harrassment, bullying at work, aggression, violence and discrimination)
Address:
Occupational Health Department (GBGD), Poortgebouw Zuid (3rd Floor), Rijnsburgerweg 10, 2333 AA Leiden
Telephone: 071-527 8015

In addition

Information Management Group (Informatie Beheer Groep (IBG))
Regiokantoor IBG (Regional Office)
Koninginnegracht 12b/13, 2514 AA Den Haag,
tel. 050 599 77 55
Office hours: Monday through Friday from 9:00 to 17:00 o'clock.
vragen@ib-groep.nl / www.ib-groep.nl

Stichting Leidse Studentenhuisvesting (SLS) (Foundation for Leiden's Student Housing)
Visiting address: Doelengracht 4b, 2311 VM, Leiden
Postal address: Postbus 11275, 2301 EG, Leiden
Telephone (071) 516 1718
www.sls.nl

SAFETY INFORMATION LEIDEN UNIVERSITY

What to do in case of a fire, incident or other calamity?

DON'T CALL 112!

but

DO CALL THE EMERGENCY NUMBER (see the orange sticker on the phone or after office hours: 4444)

IN CASE OF FIRE

- ★ ACTIVATE the fire-alarm-button
- ★ In case of a STARTING OR SMALL FIRE
  - try to extinguish the fire
  - use the handheld extinguisher or the fire hose
- ★ In case of a LARGE FIRE
  - Close doors and windows
  - Go to the meeting point* (restaurant or car parking) and follow instructions of the first-aid-personnel (BHV-ers)

What to do if the Alarm Signal ("Slow Whoop") sounds?

CLOSE WINDOWS, LEAVE THE ROOM AND CLOSE THE DOOR.

- ★ Follow the ESCAPE ROUTE (green pictogram plates)
- ★ In CASE OF FIRE use the stairs and NEVER the elevator!

Go to the MEETING POINT* (restaurant or car parking)

- ★ Don't go home. All people who were present in the building have to be registered
- ★ Don't make the firemen look for you unnecessarily

Always FOLLOW THE INSTRUCTIONS of the firemen or the first-aid-personnel (BHV-ers)

What to do when a dangerous situation is discovered?

Fill out a REGISTRATION form

- ★ digital on amd.leidenuniv.nl
- ★ the red paper available at the reception

or

CONTACT the safety office of the faculty

- ★ amd@science.leidenuniv.nl
- ★ 071 – 527 4333

***** MEETING POINTS are indicated in the EVACUATION PLAN (ontruimingsplan) of each building. This plan is available at the reception or on amd.leidenuniv.nl/e/

The Master Programme in Mathematics

Leiden University offers six specialisations of an MSc programme in mathematics. Three of these correspond to research specialisations in the Leiden Mathematical Institute. The remaining three are the mathematics specialisation of the research MSc with Science-Based Business (SBB), Science Communication & Society (SCS) and Education (EDU) specializations.The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Mathematics, with specification of the specialisation, if applicable. Details are provided below. All specialisations have the same Director, the same Board of Examiners, and the same Department Teaching Committee. A Board of Admissions will advise on admissions. Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialisation. Individual combinations of the research programmes, with research projects from different groups, are possible in principle, depending on the decision by the Board of Examiners. The admission process may include an interview with the Board of Admissions. Foreign applicants must provide proof of proficiency in English (IELTS level 6.0). Admission is possible throughout the year, but we advise foreign students to start in September or February. Further information is available on the website

http://www.math.leidenuniv.nl/en/master

The goal of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

The mathematics courses in a master programme can be taken from

1. master courses offered in Leiden,
2. courses of the Dutch Master Programme in Mathematics,
3. master courses in mathematics offered by another institution.

Travelling expenses for participation in the Dutch Master Programme in Mathematics are reimbursed by the national organisation (see www.mastermath.nl/registration/).

For courses in the 3rd category, the student has to ask the study advisor for permission in advance.

Description of the specialisations

Specialisation Algebra, Geometry and Number theory

This is a research specialisation aimed at students who wish to acquire a profound knowledge of one of the areas within pure mathematics. There is a strong theme dealing with algebra and number theory (see the international ALGANT study programme) as well as a strong theme dealing with topology and geometry. Leiden offers courses at an advanced level ranging over topics such as algebraic number theory, algebraic geometry, cryptology and combinatorics. Some of the courses are compulsory, but there is a lot of freedom in choosing one's own topic. Some of the courses are given at the national level. The programme ends with the preparation of a Master Thesis and an oral presentation of it. The programme is suited as preparation for an academic career, in particular via a subsequent PhD study, but also for a career as mathematical researcher outside the universities.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme. For all other (international) candidates, the Board of Admissions will judge the equivalence of their previous training to these BSc degrees. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the actual knowledge of the candidate.

Programme

For each student, a programme will be tailored individually. It consists of a choice of advanced courses (at least 60 EC) from algebra, algebraic and analytic number theory, cryptology and combinatorics, and algebraic and differential geometry; a research project (at least 40 EC) and a free choice of courses from any field (maximum 20 EC); required is a total of at least 120 EC. **It is compulsory that at least 30 EC be obtained from courses from the national Mastermath programme.**

ALGANT

The Erasmus Mundus study programme ALGANT is a EU funded international master programme in algebra, geometry and number theory, jointly offered by the universities of Bordeaux, Leiden, Orsay and Padova. This programme is open to non-Dutch master students. Students following this programme are obliged to take courses from two of the participating universities.
More information about the ALGANT programme can be found on the webpage http://www.math.u-bordeaux1.fr/ALGANT/

Specialisation Applied Mathematics

This is a research specialisation aimed at students who wish to become thoroughly acquainted with mathematics as it is applied in various aspects of life. There is a strong theme dealing with Bioscience (see the Leiden Bio Science Initiative), as well as a strong theme dealing with industry and operations research. Leiden offers courses at an advanced level ranging over topics such as dynamical systems, industrial statistics, numerical analysis and probability theory. Some of the courses are compulsory, but there is a lot of freedom in choosing one's own topic. Some of the courses are given at the national level. The programme ends with the preparation of a Master Thesis and an oral presentation of it. The programme is particularly suited as preparation for a career as mathematical researcher in industry, government and other institutions, but also for an academic career, in particular via a subsequent PhD-study.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme. For all other (international) candidates, the Board of Admissions will judge the equivalence of their previous training to these BSc degrees. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the actual knowledge of the candidate.

Programme

For each student, a programme will be tailored individually. It consists of a choice of advanced courses (at least 60 EC) on differential equations, dynamical systems, analysis of industrial problems, measure and integration theory, probability theory, statistics, functional analysis, numerical analysis, operations research; a research project in mathematics (at least 40 EC, including 7 EC for the thesis and an oral presentation) and a free choice of courses from any field (maximum 20EC); required is a total of at least 120 EC.
It is compulsory that at least 30 EC be obtained from courses from the national Mastermath programme.

Specialisation Statistical Science for the life- and behavioural sciences

The MSc programme Statistical Science provides students with a thorough introduction to the general philosophy and methodology of statistical modelling and data analysis. Students gain knowledge of statistical methods and research designs as used in a broad range of empirical research, and practical skills such as statistical programmeming, statistical consultation, and written and oral presentation of research results. Students can specialise in applications pertaining to the life sciences or the behavioural sciences.

Qualifications for admission

Students with a wide range of bachelor degrees may apply for admission, but the bachelor's degree must include at least one introductory course and a more advanced course in statistics or probability. The candidate student should submit a letter (1 page) stating the student's motivation to apply to the programme, and a Curriculum Vitae, including the courses and credits in the Bachelor programme.
The courses will be taught in English, so proven proficiency in English is required for non-native English speakers (IELTS level 6.0). For information: www.math.leidenuniv.nl/statscience/.

Programme

The nominal duration of the programme will be two years (120 ECTS). The study time may be substantially reduced for students with particular prior knowledge. The programme consists of courses and colloquia (84 EC), and an internship and writing of a Master Thesis (36 EC). See for more information on the specialisation Statistical science the website:
http://www.math.leidenuniv.nl/statscience

Specialisation Mathematics and Science-Based Business

The MSc programme Mathematics and Science-Based Business (SBB) prepares students for a career in science-related business and administration and for innovation and enterprise from a mathematical perspective. In addition to knowledge in mathematics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with a MSc in Mathematics and Science-Based Business are also admissible to a PhD programme.
In order to get a SBB Master annotation, a minimum programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the "free choice" part of the research MSc programmes "Algebra, Geometry and Number theory" and "Applied Mathematics".

Qualifications for admission
Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme. For all other (international) candidates, the Board of Admissions will judge the equivalence of their previous training to these BSc degrees. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the actual knowledge of the candidate.

Programme
Mathematics

The Mathematics component of the Science-Based Business (SBB) specialisation consists of
- a research project of 40 EC in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation,
- 20 EC of courses to be selected in correspondence with the research topic, and
- a mathematical project connected with the SBB training period (see below).

Science Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components:

Mandatory:	level	EC
SBB Fundamentals	400	15
SBB Internship	500	23-34
Optional:		
Orientation on Entrepreneurship: Entrepreneurial Management	400	5
Orientation on Entrepreneurship: Business Planning	400	5
SBB electives	500-600	0-20
Extension of the mathematic component		0-20

See for more information on Science-Based Business the following website: http://www.sbb.leidenuniv.nl/

Specialisation Mathematics and Communication

The MSc programme Mathematics and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularisation of science, for example, as a scientific writer or public relations officer. The programme includes a 60 EC Mathematics component. Students with a MSc in Mathematics and Education are also admissible to a PhD programme in Mathematics or in Science Communication.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme. For all other (international) candidates, the Board of Admissions will judge the equivalence of their previous training to these BSc degrees. Preferably, the BSc programme has included the 10 EC course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON) or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme

Mathematics (60 EC)

The Mathematics component of the Communication specialisation consists of
- a research project of 40 EC in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation, and
- 20 EC of courses to be selected in correspondence with the research topic.

Communication (60 EC)

Language: Fluency in Dutch is required; the MSc-course Science Communication & Society fundamentals will be given in Dutch.

The Master specialisation 'Science & Communication is offered by lecturers in Science Communication & Society (SCS). Students participating in one of the MSc-programme's of the Faculty of Sciences and the MSc Biomedical Sciences (LUMC) are admitted to this MSc-specialisation.

The first year of the MSc-programme (60 EC) focuses on scientific topics (e.g. Physics, Astronomy or Biology). Specialization in communication (60 EC*, with a minimum of 40 EC*) will be achieved in the second year.

The main elements of the MSc-specialisation SCS are (as defined by the Education and Examination Regulation; OER in Dutch):

- Science Communication & Society fundamentals – (level 400/500); 17 EC
- Internship – (level 500/600); 23 EC

The total adds up to a minimum of 40 EC.

The following options are possible to fill in the remaining 20 EC of the second year of the MSc-programme:

- Extension of the internship to a maximum of 34 EC – (level 500/600); 0-11 EC
- Masterthesis – (level 500/600); 5 EC
- Communication research connected to the internship, in preparation of the masterthesis – (level 500/600); 4 EC
- Electives in communication – (minimum level 400); 0-8 EC
- Courses within own scientific background – 0-20 EC

An internship can be done in the follow areas of expertise:

- Journalism, e.g. at a:
    - Popular-scientific magazine
    - Scientific editorial board of a newspaper
    - At a scientific programme on radio or TV
        - Including website content management
- Museology, e.g. at a:
    - Science-museum
    - Scientific centre
    - Zoo
        - Educational programme
        - Exhibitions
        - Websites
- Communication and Education, e.g. at a:
    - Nature conservation organisation
    - Agency for science-communication and education
        - Educational programme's
        - Materials for educational purposes

SCS closely cooperates with the MSc-specialisation 'Journalistiek & Nieuwe Media' (MSc Dutch Language and Culture, Faculty of Humanities, Leiden University). Courses in scientific communication can be taken at other universities (e.g. TU Delft, Wageningen UR or Vrije Universiteit). The minimal level of the electives is 400.

Before participating in the MSc-specialisation 'Science & Communication' the complete programme, including electives, should be presented to the SCS-coordinator (prof. dr. Jos van den Broek and the study-coordinator of the own MSc-programme for approval.

See for more information on the specialisation Science & Communication the website: http://www.science.leidenuniv.nl/index.php/scs

Specialisation Mathematics and Education

The MSc programme Mathematics and Education prepares students for a career in teaching Mathematics. The programme includes a 60 EC Mathematics part. Students with a MSc in Mathematics and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme. For all other (international) candidates, the Board of Admissions will judge the equivalence of their previous training to these BSc degrees.
Preferably, the BSc programme has included the 10 EC course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON) or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme

Mathematics

The Mathematics component of the Education specialisation consists of
- a research project of 40 EC in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation, and
- 20 EC of courses to be selected in correspondence with the research topic.
Some of these courses may be taken from the national Mastermath programme (see the list of courses below).

Education

The Education part of the MSc programme Mathematics and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

	level	EC
Teaching methodology	500	10
Professional functioning	300	12
Specialisation	600	8
School training	400	30

In their specialisation, student teachers develop their competences to innovate their practice (e.g., by developing and testing instruction on a specific topic).
This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" in mathematics needed for teaching at Dutch high schools.

See for more information on the specialisation Education the website:
http://www.iclon.leidenuniv.nl/studenten/master/opleidingsvarianten/tweejarig-vakmaster.html

Courses of the DUTCH MASTER PROGRAMME IN MATHEMATICS

You find below a list of all master courses offered in 2011/2012 in the framework of the Dutch Master Programme in Mathematics. For descriptions of these courses and further details see

www.mastermath.nl

or, even better, ask the study advisor or a faculty member for advice.
Only the courses offered on Mondays-Thursdays are eligible for a master specialisation in Algebra, Geometry and Number theory or in Applied mathematics. The courses offered on Fridays are meant specifically for a master specialisation in Mathematics and Education.

Please notice: registration via www.mastermath.nl is compulsory.

Details in the schedules below may be subject to change; for up-to-date information please visit the website.

Abbreviations:

CWI Centrum voor Wiskunde en Informatica (Amsterdam)
RUG Rijksuniversiteit Groningen
RUN Radboud Universiteit Nijmegen
TUD Technische Universiteit Delft
TU/e Technische Universiteit Eindhoven
UL Universiteit Leiden
UT Universiteit Twente (Enschede)
UU Universiteit Utrecht
UvA Universiteit van Amsterdam
VU Vrije Universiteit Amsterdam

Mastermath programme Fall 2011

Course	Teacher	EC
Monday and Tuesday (UU)		
Introduction to stochastic processes (Crash course, 5,6,12,13 sep)	Boxma/Adan (TU/e)	4
Monday (UU/UT)		
Systems and control (intensive course)	Polderman (UT,disc)	6
Monday (UU)		
Continuous optimization	Still (UT)	6
Discrete optimization	Uetz (UT)	6
Heuristic methods in operations research	Hurink, Schutten (UT)	6
Tuesday (UU)		
Functional analysis	Ran (VU), de Jeu (UL)	8
Dynamical systems	Diekmann, Kuznetsov (UU)	8
Tuesday (VU)		
Elliptic curves	Lenstra, v. Luijk (UL)	8
Automatic sequences	Bosma (RUN), Fokkink (TUD)	8
Wednesday (UU)		
Operator algebras	Landsman (RUN)	8
Differential geometry	Crainic (UU)	8
Parallel algorithms	Bisseling (UU)	8
Numerical Linear algebra	Sleijpen (UU)	8
Wednesday (UvA)		
Measure theoretic probability	Spreij (UvA)	8
Asymptotic statistics	Kleijn (UvA)	8
Thursday (UU) [1])		
Advanced algebraic geometry	Edixhoven (UL)	8
Random polymers	den Hollander (UL)	8
Friday (UU) [2])		
tba		6
Probability and statistics	Tijms (VU)	6

[1]) Advanced courses for second year master students or graduate students

[2]) These courses are only allowed for a master specialisation Mathematics and Education

Mastermath programme Spring 2012

Course	Teacher	EC
Monday (UU/UT)		
Advanced modelling in science (intensive course)	Heemink (TUD)	6
Applied finite elements (intensive course)	vd Vegt (UT)	6
Monday (UU)		
Stochastic differential equations	vd Weide (TUD)	6
Applied statistics	Castro (TU/e)	6
Non-linear systems theory	vd Schaft, Scherpen (RUG), Jeltsema (TUD)	6
Advanced linear programming	Stougie (VU), Canzar (CWI)	6
Scheduling	Hurink (UT)	6
Queueing theory	Scheinhardt (UT)	6
Intuitionistic mathematics	Veldman (RUN)	8
Lambda calculus as formalism for computations and proofs	Barendregt, Wieland (RUN)	8
Tuesday (UvA)		
Semidefinite optimization	Laurent (CWI), Vallentin (TUD)	8
Algebraic geometry	Taelman, de Jong (UL)	8
Tuesday (VU)		
Mathematical biology	Planque (VU), Diekmann (UU)	8
Variational methods	vd Berg (VU), Prokert (TU/e)	8
Partial differential equations	vd Vorst (VU)	8
Wednesday (UU)		
Lie groups	vd Ban (UU)	8
Riemann surfaces	Cavalcanti (UU)	8
Wednesday (VU)		
Numerical methods for stationary PDE's	Stevenson (UvA)	8
Stochastic processes	Spieksma (UL)	8
Time series	vd Vaart (VU)	8
Thursday (UvA) [1])		
Moduli spaces and topological field theory	Shadrin (UvA)	6
Friday (UU) [2])		
Historical aspects of class room mathematics		6
tba		6

[1]) Advanced courses for second year master students or graduate students

[2]) These courses are only allowed for a master specialisation Mathematics and Education

Master courses offered by University of Leiden and TU Delft

The list below contains all master courses in Leiden, as well as some courses offered by TU Delft that can be taken as part of a Leiden mathematics master programme.

For the descriptions of the courses in Leiden see
http://studiegids.leidenuniv.nl

For the descriptions of the courses in Delft see
http://studiegids.tudelft.nl **and type in the "Vakcode."**

Courses in Leiden, Fall 2011			
Course	**Level**	**EC**	**Teacher**
Forensic statistics and graphical models	500	6	R. Gill
Introduction to algebraic topology	400	6	R. de Jong
Introduction to dynamical systems	400	6	A. Doelman
Introduction to manifolds	400	6	M. Lübke
Linear analysis	400	6	O. van Gaans
Local class field theory	500	6	B. de Smit
Measure theory	400	6	E. Verbitskiy
Numerical methods for PDE's	400	6	B. Koren
Probability	400	6	F. den Hollander
Statistical learning	500	4	P. Grünwald, W.T. Kotlowski

Courses in Leiden, Spring 2012			
Course	**Level**	**EC**	**Teacher**
Bifurcations and chaos	400	6	V. Rottschäfer
Diophantine approximation	400	6/8	J.-H. Evertse
Dynamical systems seminar	500	6	A. Doelman, V. Rottschäfer
Functional analysis seminar	500	6	O. van Gaans, S. Hille, M. de Jeu
Fundamentals of non-linear analysis	400	6	S. Hille
Gibbs measures	500	6	A. Opoku
Information theoretic learning	500	6	S. de Rooij
Mathematical biology: the virtual cell	400	6	S. Hille
Quantum cryptography	400	6	S. Fehr
Statistics	400	6	R. Gill
Symbolic dynamics & ergodic theory	500	6	C. Kraaikamp, E. Verbitskiy

Courses TU Delft, Fall 2011				
Course	**EC**	**level**	**vakcode**	**Teacher**
Operator semigroups and numerical analysis [1])	6	500		Dr. M. Haase
Partial differential equations 1&2 [2])	6	200	WI3150/ WI4150	W.T. van Horssen, H.M. Schuttelaars

Courses TU Delft, Spring 2012				
Course	**EC**	**level**	**vakcode**	**Teacher**
Advanced topics in analysis	6	400	WI4211	K.P. Hart
Advanced topics in decision theory	6		WI4139	D. Kurowicka
Control of Discrete-time stochastic systems	6		WI4221	J.H. van Schuppen
Fourieranalyse (Dutch)	6	400	WI3601	B. de Pagter
Part. diff. vergelijkingen (Dutch) [2])	6	200	WI2607	W.T. van Horssen
Stochastic operations research	6		WI4057	G. Hooghiemstra
Voortgezette kansrekening (Dutch)	6	400	WI4614	L.E. Meester
Wavelets	6	400	WI4005	W.G.M. Groenevelt

[1]) Internet seminar. For further information, see http://studiegids.leidenuniv.nl or contact M. de Jeu.

[2]) This is a basic bachelor course which is allowed in a master programme only in certain situations. Please consult the study advisor if you are interested in this course.

Courses of the Master specialisation Statistical Science

The Master specialisation Statistical Science for the life- and behavioural sciences is aimed at students who do not necessarily have a BSc-degree in mathematics. However, some of the courses
of this specialisation, in particular Statistical learning, are suited for students following the Master specialisation applied mathematics. If you are interested in one of these courses, contact your thesis- or study-advisor to make sure it fits in your programme. The courses offered in 2011/2012 are the following.

First semester - Fall 2011			
Course	**Level**	**EC**	**Teacher**
Statistics and probability	400	9	E. van Zwet
Mathematics for statisticians	300	4	F. Spieksma
Introduction to life and behavioural sciences	400	5	T. Stijnen
Linear and generalized linear models and linear algebra	400	9	G. Gort
Statistical computing with R	300	3	P. Eilers

Second semester - Spring 2012			
Course	**Level**	**EC**	**Teacher**
Multivariate analysis and multidimensional data analysis	400	6	C. ter Braak
Bayesian statistics	400	6	E. le Saffre
Mixed and logitudinal modeling	400	6	B. Engel
Survival Analysis	400	6	H. Putter
Study design in the life and and behavioural sciences	400	6	S. le Cessie

Third semester - Fall 2011			
Course	**Level**	**EC**	**Teacher**
Statistical learning	500	4	P. Grünwald, W. Kotlowski
Psychometrics and SEM	500	6	Kelderman
Statistical consulting	500	6	W. Heiser
High dimensional data analysis	500	6	J. Goeman
Statistical genetics	500	6	J. Houwing
Preparation for Master's thesis		2	

Master courses outside Delft or Leiden

Interuniversity programme Stochastics and Financial Mathematics
(see http://www.math.vu.nl/sto/onderwijs/sfm/index.html)